DEALING WITH THE MANUFACTURE, USES AND POTENTIALITIES OF PLASTIC MATERIALS

CHNOLOGY DEPT.

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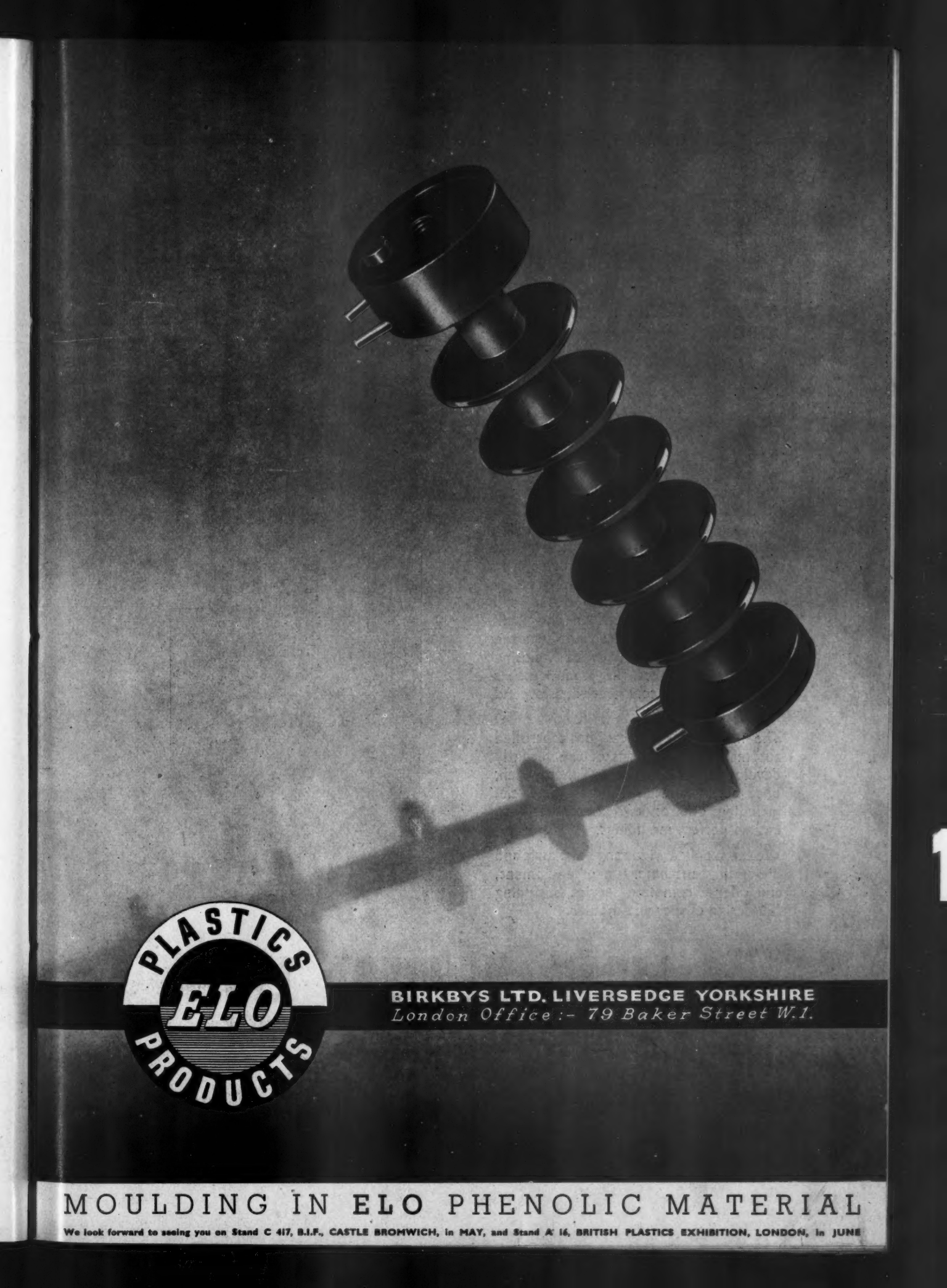
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A NEW 75-TON TRANSFER PRESS

MADE BY T. H. & J. DANIELS LTD., STROUD

A new self-contained plastic-moulding press of streamlined design, operated by a vane-type pump, which is integral with the base of the control panel. The Press has a daylight of 16" between the 18" square electrically-heated platens. The main ram is 10" in diameter and a stroke of 14" is available. The transfer unit has a 2½" diameter ram of the annulus type with a stroke of 4" and a total transfer load of 12.5 tons. A slow closing and opening device is fitted in the main hydraulic circuit so that, although the ram moves very rapidly on both closing and opening strokes, the last few inches of movement are comparatively slow and steady.

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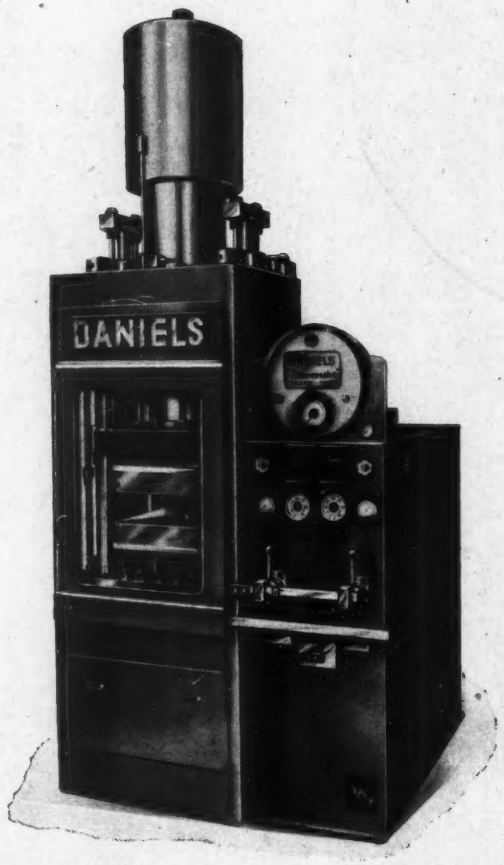

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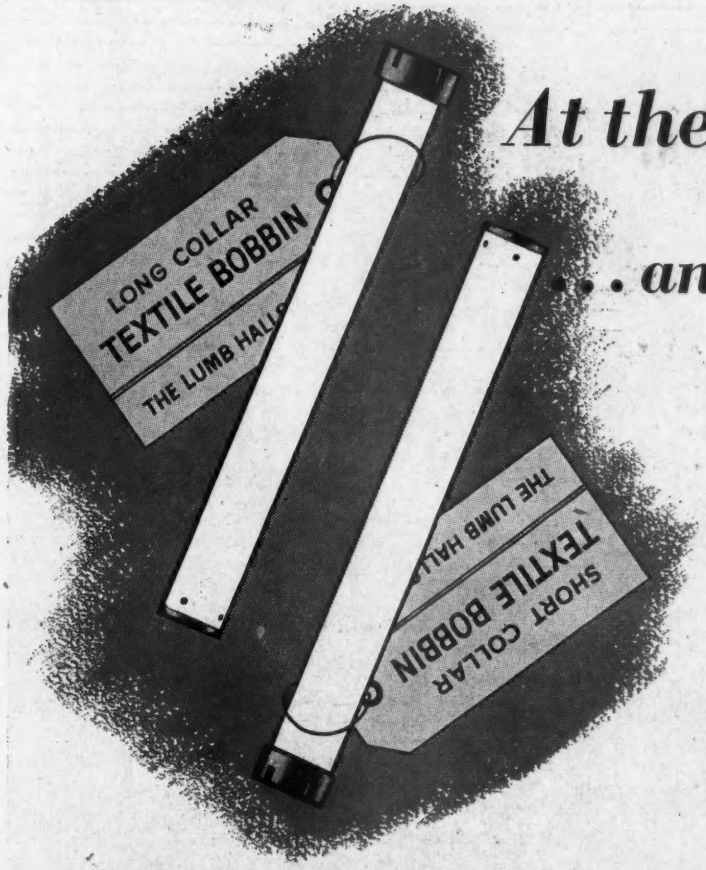

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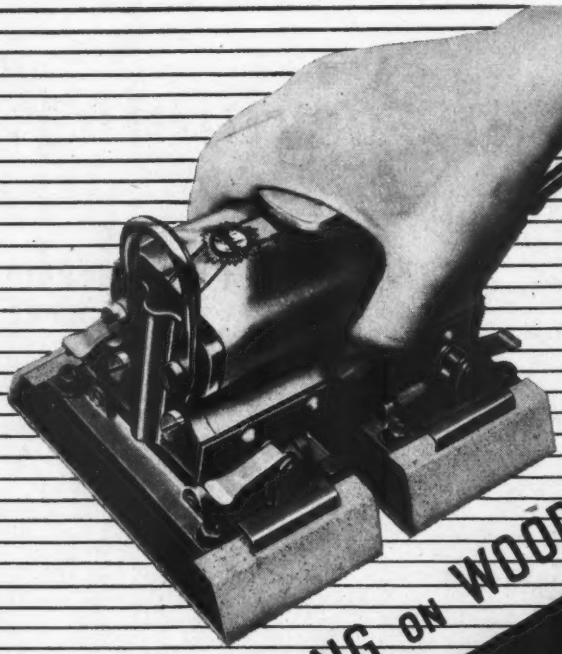
CELLOMOLD COLOUR-RANGE TRIANGLES *numbered for quick, easy reference are available free on request.* *"Cellomold" is a Registered Trade Mark*



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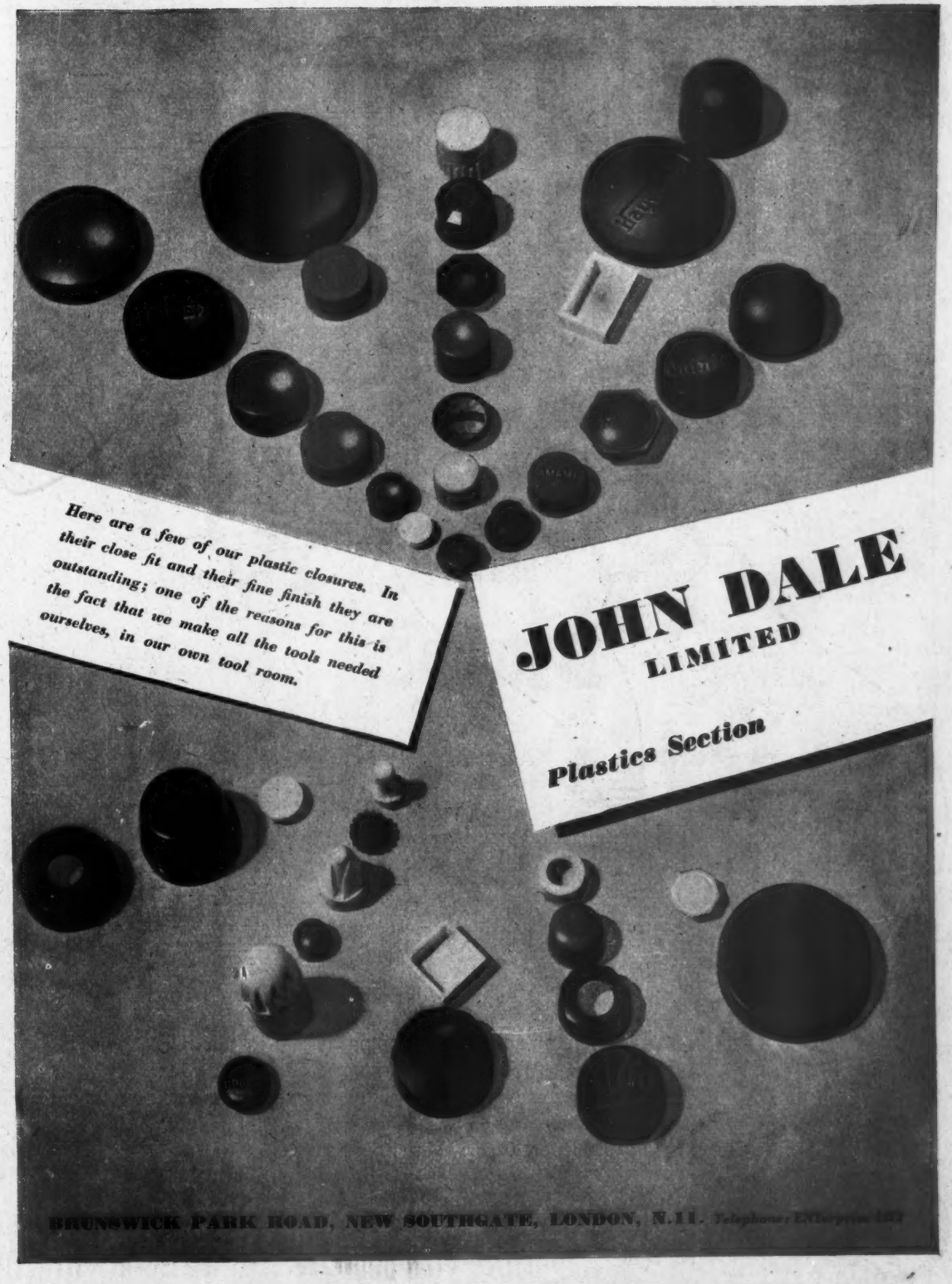
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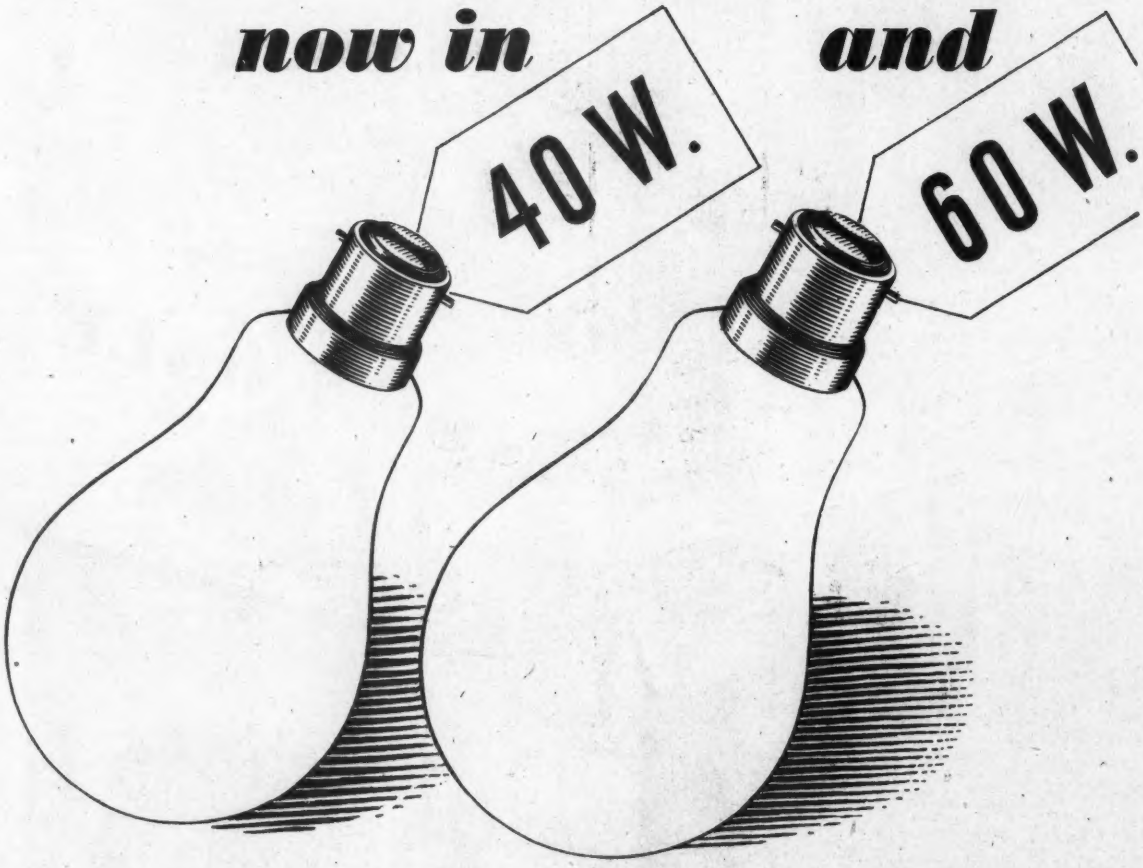
now in 40W. and 60W.



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On your right a compression moulded "table" radio cabinet, its acute curves strengthened by ribs, its fluted louvres moulded to a curved section. A high standard of durability and finish was expected—and achieved . . . .

BOXING CLEVER!

. . . . **On your left** an ivory cabinet for enclosing a portable radio receiver, injection moulded to an impeccable finish. Note the louvres, cunningly designed to "frame" the speaker without impeding the sound. The back is of the same material, accurately moulded to a perfect fit. The designers of these fine examples of precision moulding—PHILCO—entrusted the production of them to Ekco Plastics. Ekco offer a complete moulding service including design, tool making, quantity production—and wiring, assembly and testing when required.

TECHNICALLY THE FOLLOWING POINTS ARE OF INTEREST —the Ivory coloured portable cabinet was moulded in Polystyrene, using a 32oz. injection press, the handle lugs being incorporated in the moulding. The back was moulded in the same material and is complete with hinge parts and positioning lugs.
The "table" radio cabinet is a Phenol formaldehyde compression moulding with an accurate simulation of walnut and an extremely high finish.

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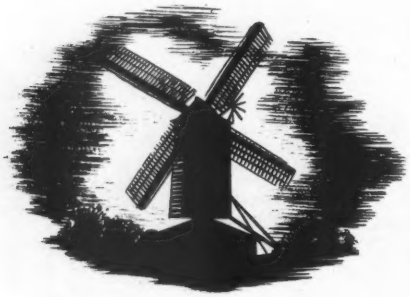

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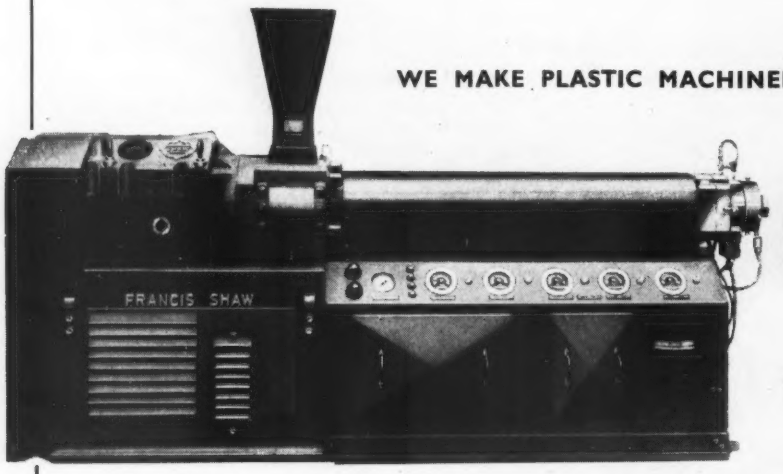

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The illustration shows our 4½" Plastic Extruder

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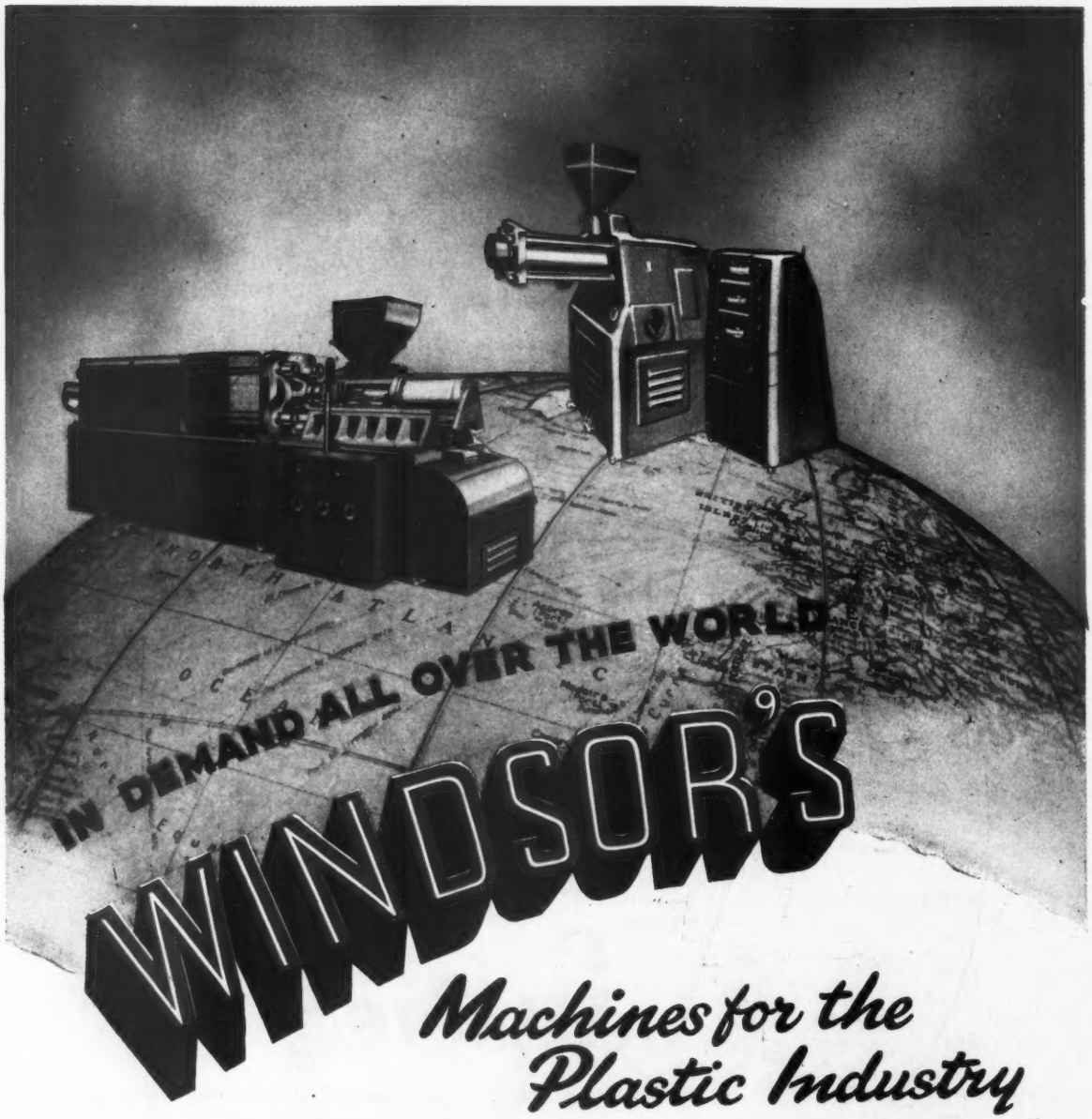

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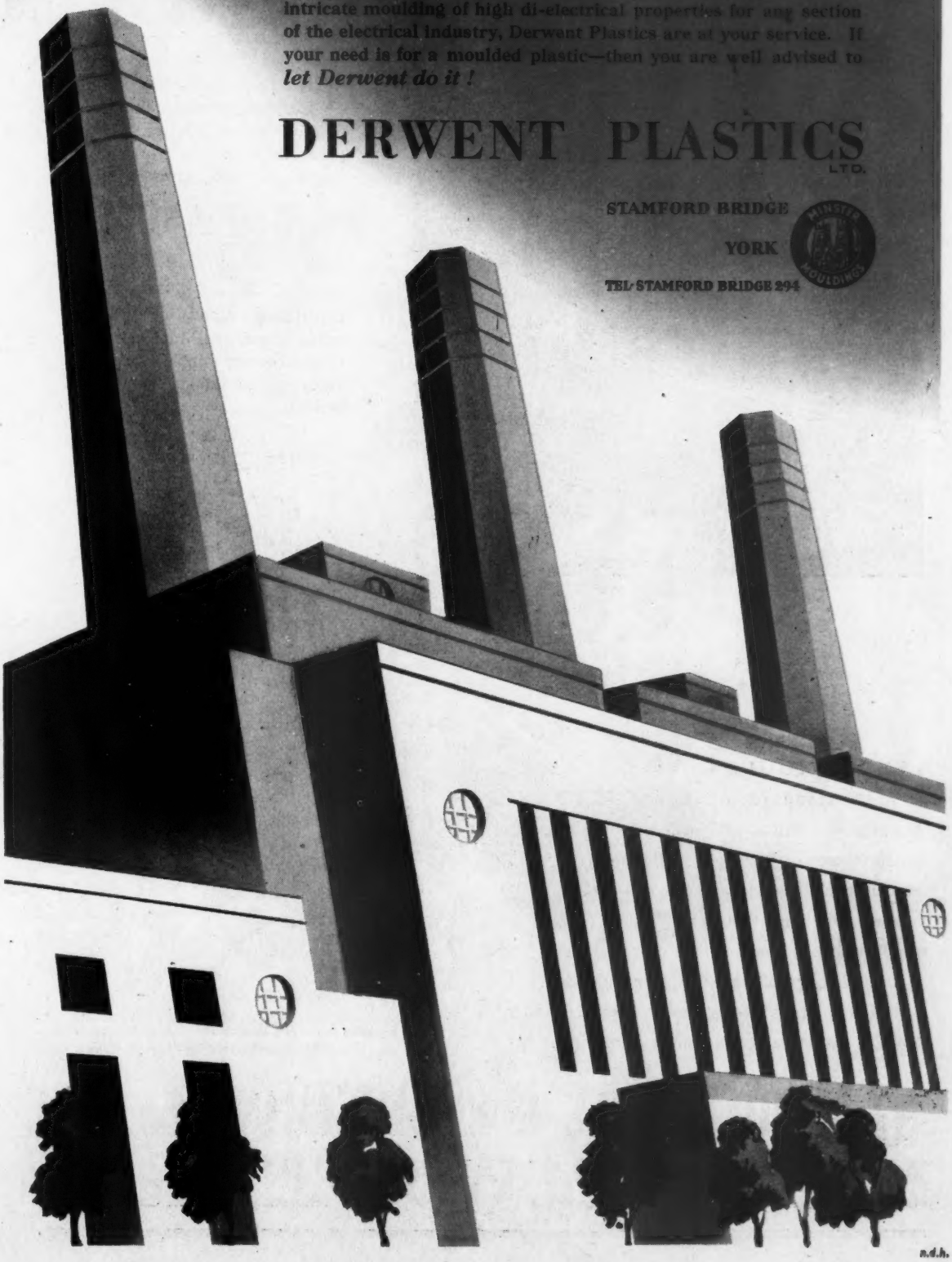


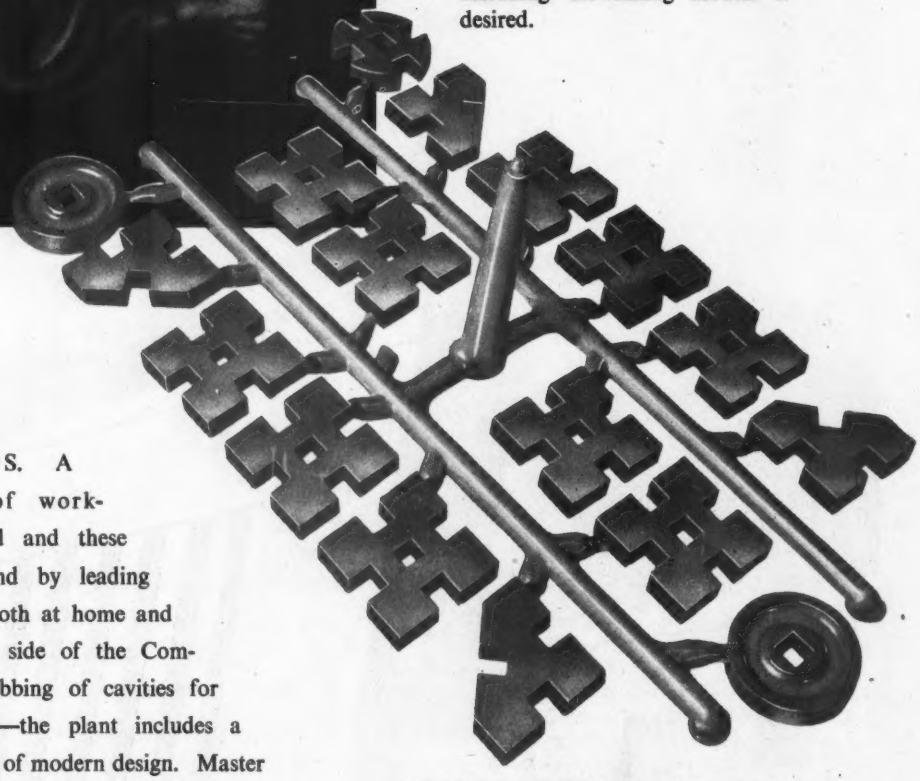
n.d.h.

moulds...

THE Projectile & Engineering Co., Ltd., specialise in service to the Plastics Industry. Their productions include Moulds as well as the well-known series of

PECO

Injection Moulding Machines. Expert designers and Mould makers are employed and Moulds can be supplied to any sample submitted, including die-sinking models if desired.



PECO MOULDS. A high standard of workmanship is maintained and these products are in demand by leading Plastics manufacturers both at home and overseas. An important side of the Company's work is the hobbing of cavities for moulds and medallions—the plant includes a 3,000-ton Hobbing press of modern design. Master Hobs to customers' samples made as required.

Moulded from a Peco Mould by Messrs. PlastOmatic Limited for the Abbey-Corinthian Games Co. (Patent No. 573378)

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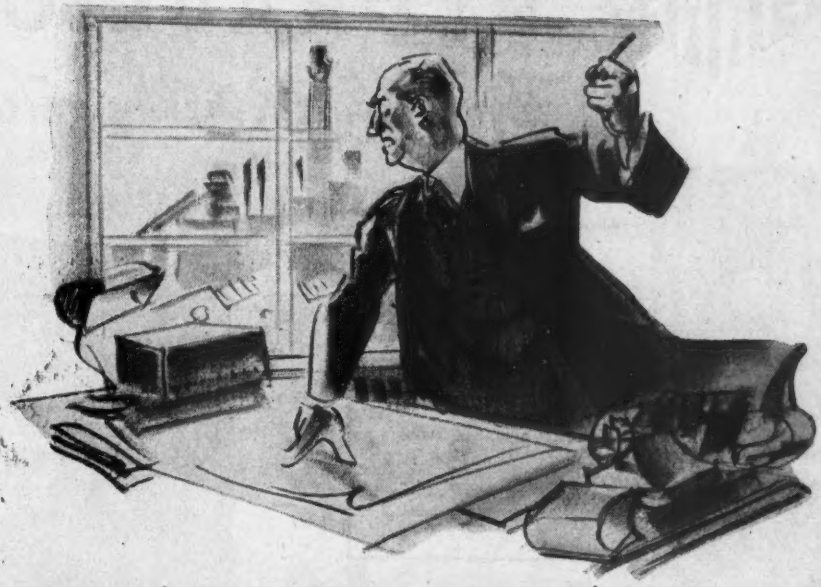
Telephone: Macaulay 1212

Telegrams: "Profectus, Claproad, London"

He used to do it the hard way,



....now he leaves it to Lorival

L22

Lorival know what kind of service you want when you order plastic or ebonite mouldings to incorporate them in your own product. It should not be necessary for you to bother with technical details of plastics manufacture. If you will collaborate with us from the start, then you can think about something else until the delivery date.

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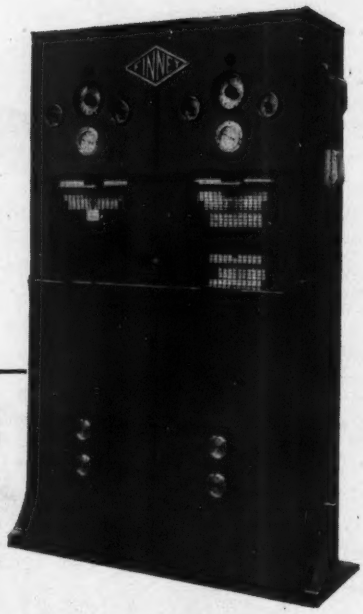

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Automatic interlocking guards.
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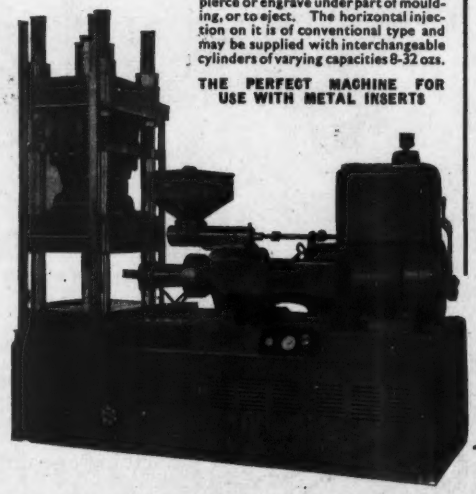

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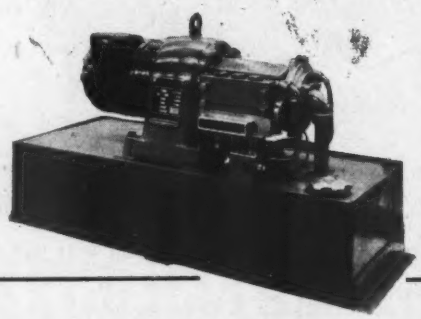

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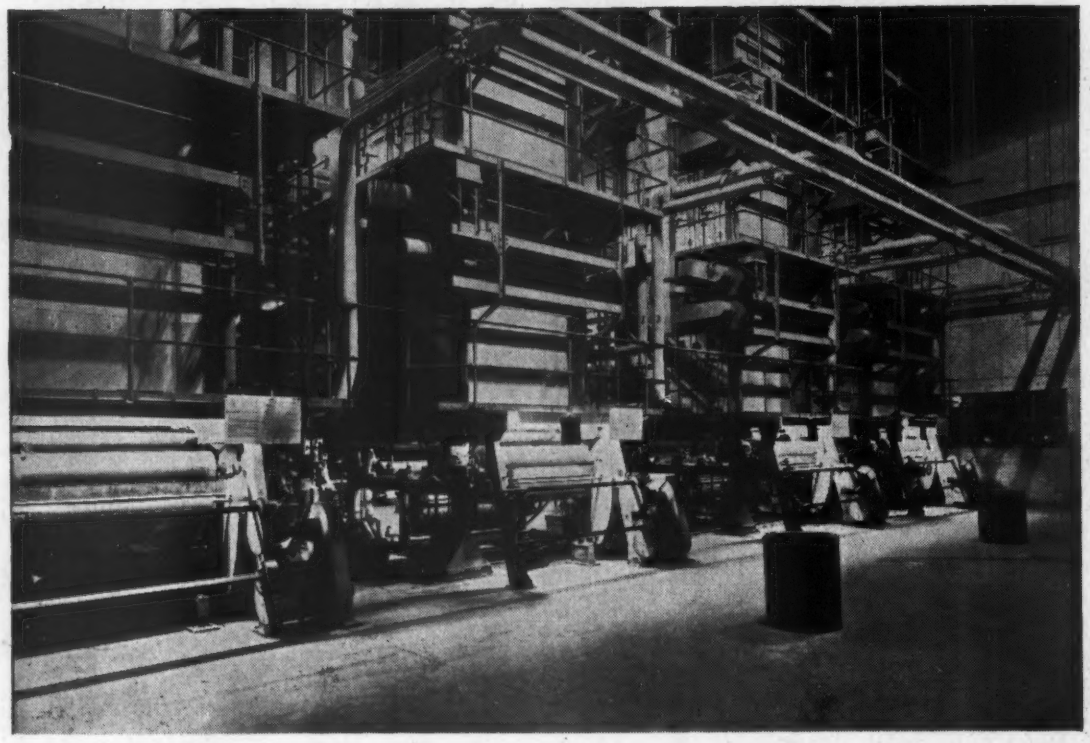
Another Osram fluorescent installation



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- Timed injection cycle prevents "scamped" mouldings
- Dies have 136-ton direct lock—no toggles to wear or jam
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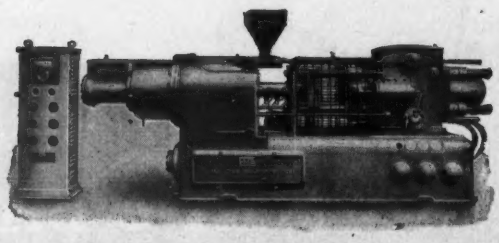
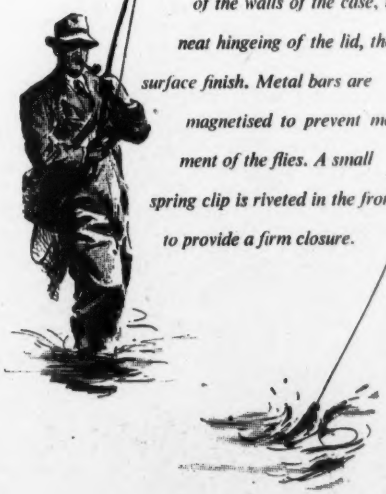
Distance between bars	11¾ in. x 10 in.
Maximum and minimum die thickness	12 in.—2 in.
Movement of die platen	7¾ in.
Maximum area of work at 7 tons/sq. in.	36 sq. in.
Locking force	136 tons
Injection pressure	4 oz. cyl. : 7·6 tons/sq. in. max. 2 oz. cyl. : 11.9 tons/sq. in. max.



E.M.B. Co., Ltd. West Bromwich England

Note the thick cross-section of the walls of the case, the neat hingeing of the lid, the fine surface finish. Metal bars are magnetised to prevent movement of the flies. A small spring clip is riveted in the front to provide a firm closure.



Fishermen require fine tackle and Milwards of Redditch make it. So when this well-known firm decided to market a new fly case, their first concern was for quality. The result is this neat container designed by Roanoid Plastics Ltd. and moulded by them from Beetle moulding powder.

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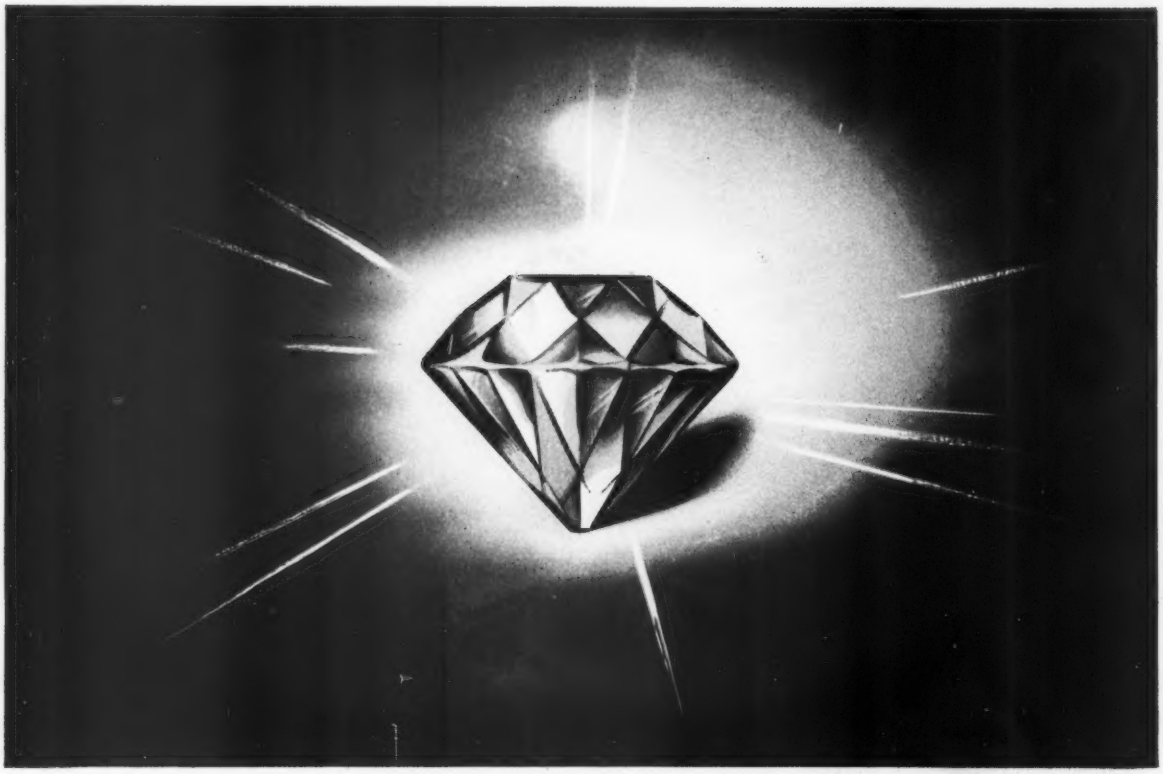

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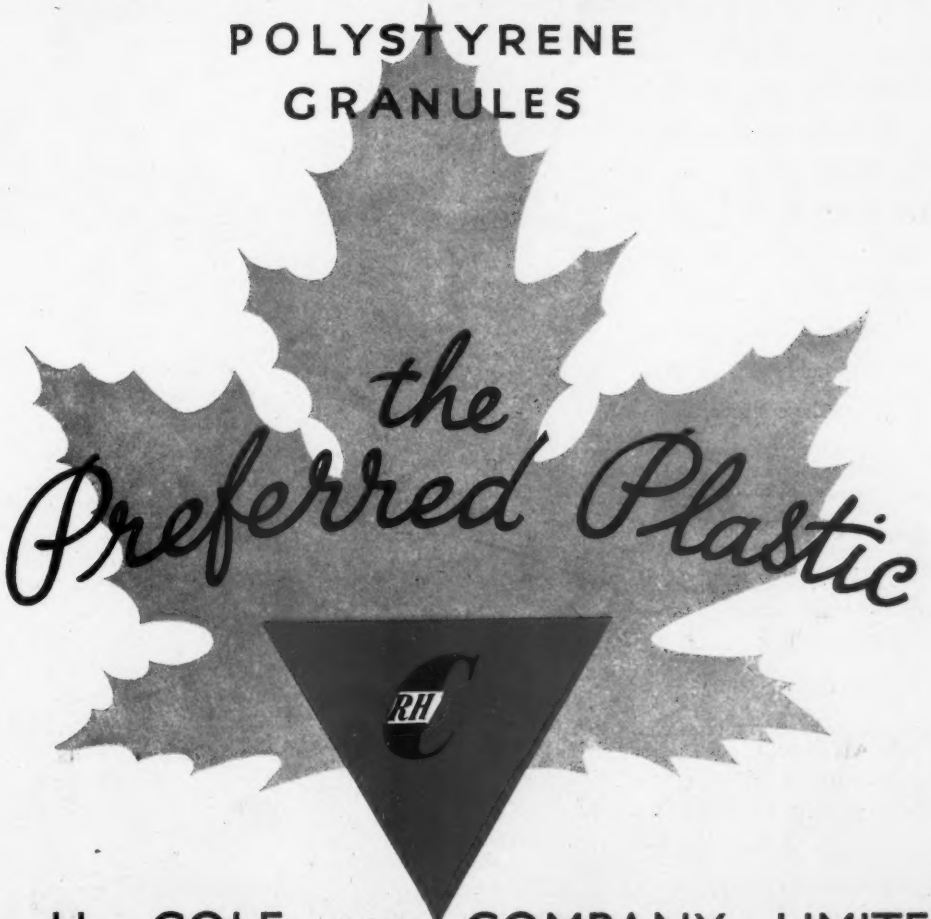

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Plastics

DEALING WITH THE MANUFACTURE, USES AND POTENTIALITIES OF PLASTIC MATERIALS

PROPRIETORS: TEMPLE PRESS LIMITED

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EDITOR: M. D. CURWEN B.Sc., A.R.I.C.

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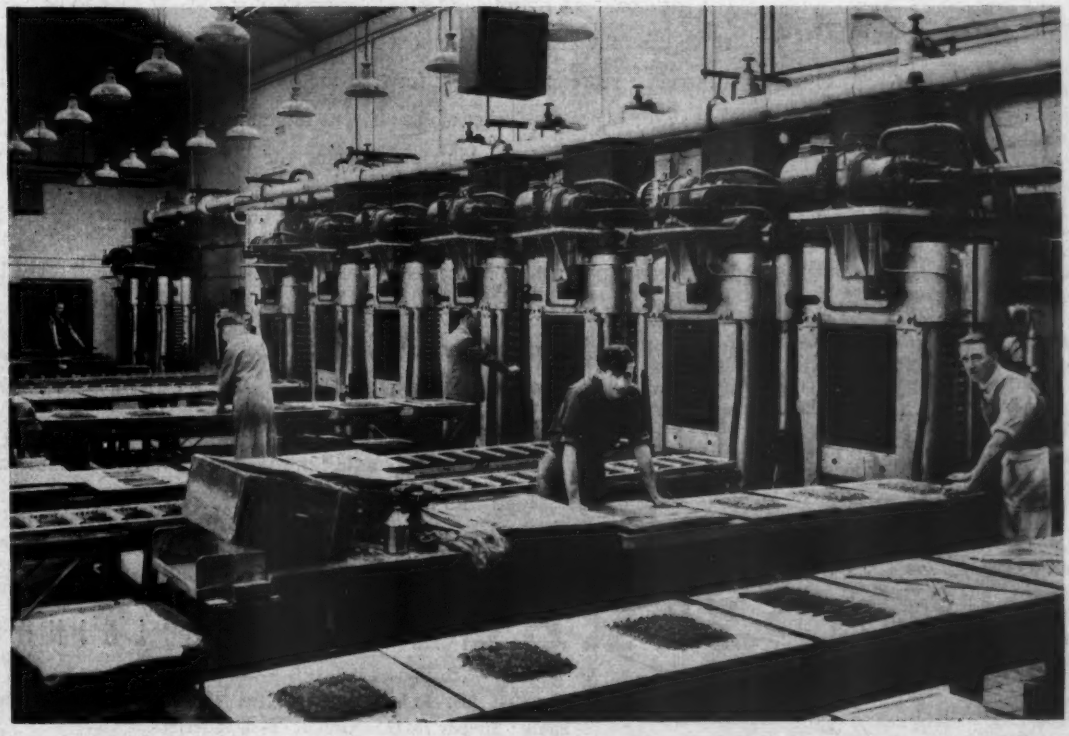
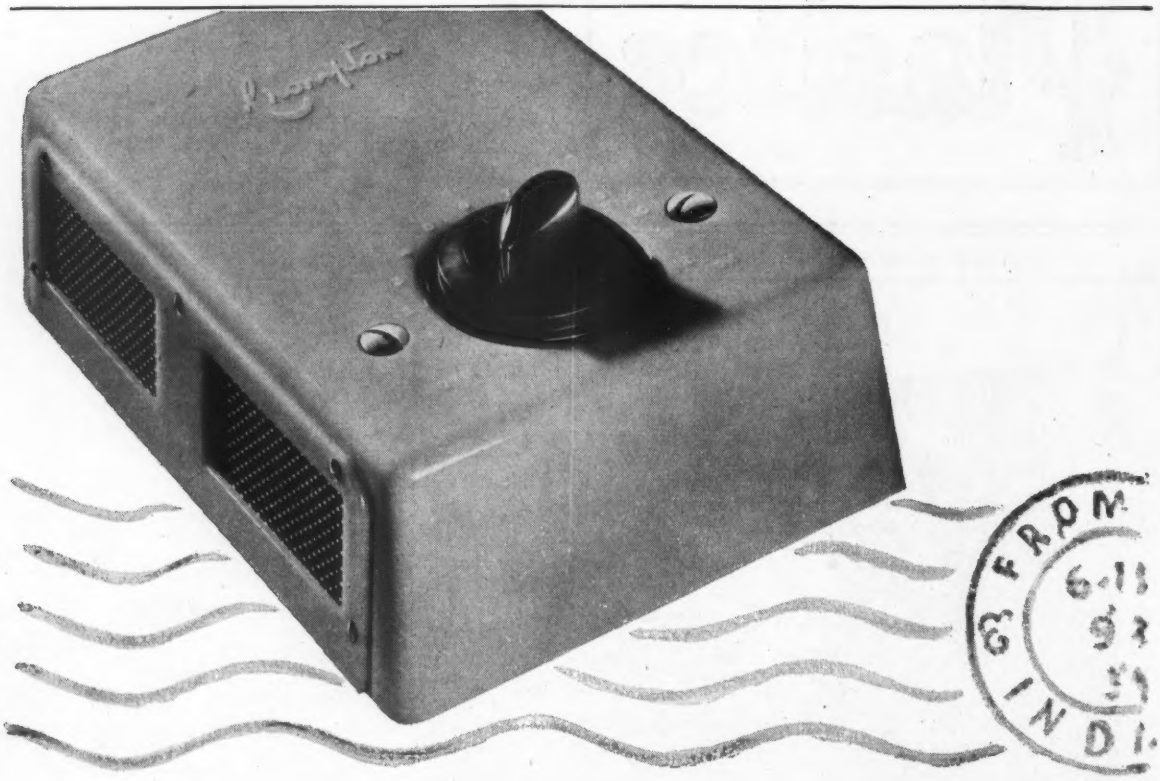


General view of a battery of multiple-platen casein sheet presses at the works of Erinoid Ltd. These presses are now operated by individual pumps.



FAN-MAIL FROM INDIA

The parts of this Crompton-Parkinson fan regulator housing have to be moulded within carefully defined limits and a high finish is required of the external components. Although it represents a straightforward compression moulding job, details such as the ingenious design of the air vent claim attention. This consists of wire gauze held between two moulded plates, the whole being assembled as a single unit. In addition to the housing and control knob, there is an internal contact plate having metal inserts.

These mouldings, simple in themselves, nevertheless underline Streetly RELIABILITY. We have been moulding them for Crompton-Parkinson Ltd. for 13 years, during which our customer has received many thousands of orders from India and the Middle East. During that long period our own high standard of moulding and finishing and meticulous system of inspection have contributed significantly to our customer's own smooth production. Even if we mould a small percentage of rejects (and who doesn't), the customer never sees them. *We* weed them out, *before* delivery.

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Plastics

VOL. XVI. No. 163 FEBRUARY, 1951

"The horns of oxen being, when hot, soft and ductile, the horner presses them into a variety of forms, and makes tumblers, spoons, snuff boxes, ink horns, etc., and in some work he uses the lathe and turns the horn when cold. . . . Those who practice this art make horn buttons, which can hardly be distinguished at a distance from those of mohair and horsehair, by pressing them while hot in moulds, and afterwards dyeing them. The horns of oxen are cut into several rings about an inch or an inch-and-a-half broad, and being held over the fire, these rings when softened by heat are cut and pulled open with a pair of pincers. They are then placed between hot iron plates and pressed with great force until they are spread and become as thin as the workman would have them; this operation is repeated in order to make horns for lanterns, horn-books, etc., by heating fresh irons and again putting them in the press until they become transparent, and almost as thin as a sheet of paper."

Joseph Collyer, writing of the horner's craft in "The Parents and Guardian's Directory and the youth's guide in the choice of a profession or trade," 1761 (quoted in "A Short History of the Horners' Company," by F. T. Fisher, 1936).

EDITORIALS

Plastics v. Metals

THOSE of our readers who study the financial papers will have noted at least one fact: the spurt in the rise of shares in the few larger plastic manufacturers and moulders that are listed therein. During the month of January they rose 20-25 per cent. and in one or two individual cases about 100 per cent. over the 1950 figures. To-day in the beginning February they have receded somewhat, but are still well above those of last year. Those readers may have also noted another fact in all papers: the rapid drop in price of shares of many companies using the non-ferrous metals zinc, aluminium, etc., a result due to the present scarcity of these metals because of world stock-piling and world armament programmes. The cry in this field is, as our American friends once put it in units of dimes, "Brother, can you spare a ton?"

Obviously there has been a strong connection between these two facts; it is a result, in part at least, of the presumption that if metals remain in short supply they can and will, in part, be replaced by plastics. Since this is a state we have long worked for (with rigid adherence to the principle that "fitness of purpose" as the only means of attaining it), there is no doubt that the present situation is fraught with interest for the plastics industry. Even so, those whose ingenuity of mind suggests that shortage of metals may be satisfied by plastics generally, are treading on dangerous ground.

But the situation is also fraught with exceptional dangers since plastics themselves, as we all know, are and have been for some considerable time, in short supply. It would be tragic if those whose activities we fought against in the middle of the 1940s went about their unpleasant occasions to create a black market in raw materials. It would be worse if they also began manufacturing, as they then did, finished materials of such low quality as to re-create the situation of 1948 and 1949—a revulsion by the public against unsuitable goods.

If, furthermore, such black markets and such spivvery affect, as they must, the legitimate and carefully laid plans and workings of the existing concerns in industry and of those newcomers with soundly based new ideas, then our anger should show itself in ways other than in mere words.

We all earnestly hope, therefore, that by 1952 we shall be well out of the wood so far as most supplies are concerned and become, within reason, self-sufficient.

An increase in plastics productive capacity from 180,000 tons to 330,000 tons, which is the goal, will be a remarkable achievement, but all that will be needed in view of probably normal demand. It would be futile to imagine that it could satisfy even a small fraction of a non-ferrous metal demand that is in the region of 1,300,000 tons per annum. No doubt there are more fields for us to conquer and that the future is very bright. But our moulders and fabricators keep one eye only on it. The other is understandingly fixed on the present and does not see a land flowing with phenolics, ureas, polystyrene or p.v.c.

Melamine Tableware: U.S. Standard

A RECENT article in this journal described the special significance of melamine resin moulding compounds when applied to the production of tableware because of heat resistance, strength and beauty. Manufacture in this country and of the decoration of such mouldings which has also been developed here, is one of the most satisfying in this promising field.

While progress in Great Britain so far as production and use is limited for a variety of reasons, much more rapid strides have been made in the U.S.A., where raw material is more abundant and where this type of household ware has found wide acceptance. This is reflected in the news recently received from the Society of the Plastics Industry Inc. that the first commercial standard for melamine plastic tableware has been announced by the Commodity Standards Division of the U.S. Standards Division (U.S. Dept. of Commerce, Washington, D.C.). It is identified as Heavy Duty Alpha-Cellulose-Filled Melamine Tableware, Commercial Standard C.S. 173-50 and is effective immediately.

Obviously the purpose of the standard, which was instigated by the S.P.I., is to foster maintenance of the quality of melamine ware and to provide a nationally recognized specification for producers, distributors and users. What is especially noteworthy is that the methods of test have been designed so that they can be conducted by purchasers, distributors or moulders without the use of costly equipment and without specially trained personnel. The standard covers methods of tests on materials, workmanship, thickness, finish, resistance to boiling water and resistance to dry heat.

Helping the Inventor

ON June 28, 1949, the National Research Development Corporation came into being. Its first report and statement of accounts has just been published and makes interesting reading. It may be remembered that the need for such a body arose out of the observation that while the ingenuity of British inventors was second to none, adoption of the results of their discovery and invention was often slower in this country than abroad. Thus the Corporation was set up specifically with the function of securing the development or exploitation of inventions, the result of public or other research, where the public interest so requires. It was made clear that it has no powers of compulsory acquisition of rights in inventions and does not exercise any centralized or monopolistic control over our inventive resources.

While the scheme is only a year old, the period under review has been an active one. A total of 965 inventions has been considered. Government Departments submitted 444 (these were submitted in advance), the Agricultural Research Council 2, the Medical Research Council 12, the Universities 20, and Charitable organizations 2. Of the foregoing, 64 are now under active exploitation.

Inventions submitted by the public numbered 485, but 358 were rejected and 105 were in a form too incomplete to permit the Corporation to form any opinion as to their merit. Only three in this section survived the test of assessment by experts, and the Report's comment on the results are interesting: A significant number of the submissions show that too many inventors, either through inability or unwillingness to keep in touch with the current trends in technical progress, devote energy and effort to devising inventions which industry either does not want or cannot use without complete dislocation or reconstruction. This experience is not exceptional and is paralleled by that of other organizations elsewhere.

By contrast, all the three inventions in the private inventors' section that were selected by the Corporation as meriting public support were the designs of qualified engineers with experience in the field to which they had directed attention. Two of the three were already under active exploitation.

Moulding Powder and Shot

Flutter in the Dovecote

I have recently received the following letter: " Please note that I am in the market for the following article: Bird beaks to be used for millinery mounts. I wonder whether you could let me have the names of any manufacturers who would be able to manufacture this article, which is being used in quantity throughout the year by all millinery manufacturers. At the present moment these beaks are made in France only." I mentioned this casually to a woodpecker friend of mine who feeds every morning on the bark of my old greengage trees. He looked very disgusted but merely said, " Those French birds would do anything for dough!" When I suggested the said beaks might be made from plastics, he flew off to call a meeting of his trade union to discuss ways and means. After all the country must think of dollars or francs or something.

* * *

Bags of Milk

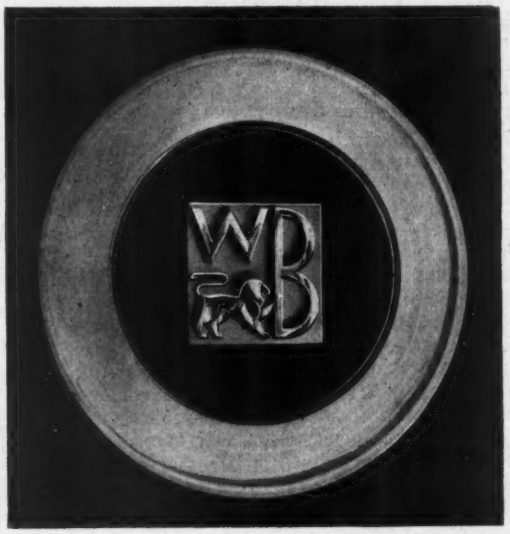
Once again the perennial question of plastic milk-bottles or, rather, containers, has cropped up—this time because of the amazing advances in packaging of liquids in sheet plastics by high-frequency sealing or heated rollers or presses. The first successful attempt in this field was the packaging of water in p.v.c. to supply troops in the jungle. To-day a famous shampoo liquid, similarly packed in p.v.c. in pillow-shaped form, is on the market. I have also some experimental samples of liquid coffee-essence and of cream in heat-seal polythene. At first sight this seems a cinch for packaging milk. The obvious advantages would be, since the package would be a throw-away one: washing or sterilization would be unnecessary and the high cost of transport and of re-collection of heavy bottles eliminated. As to the other side, the cost of a glass bottle is about 4d., and the bottle is used some 30-40 times. Milk companies would have to think hard before they'd discard a very costly washing plant. Nevertheless, the waxed-paper carton had considerable success with housewives because of unbreakability.

* * * *

Stereoscopic Plastics

When we published, some 11 years ago, our first picture of " Perspex " sheet or block, " back "-engraved to give the effect of embedded flowers when seen from the front, I fondly imagined that progress in this field would be limited to ladies' dress decorations. I was entirely wrong, for in the past year or two the basic idea, vastly improved technically to satisfy entirely different demands, has burst upon us. The advance is, I believe, essentially American in origin and first appeared as decorative badges or escutcheons on the hubs of motorcar steering wheels. The name " three-dimensional plastics " has been given to this work, but since I have yet to see a two-dimensional plastic, the name is rather silly. The effect is a stereoscopic one and the process amenable to decoration of considerable beauty. It is now being worked here by two concerns well known in the motor-accessory trade, Wilmot Breeden and Lucas's. Readers may remember the paper on this subject read before the Plastics Institute by Mr. A. A. Tomkins last year. The results are best described by reference to the photograph below of a disc made by Wilmot Breeden. The whole is a solid, transparent Diakon moulding, the top surface being smooth (it can be, of course, flat or curved), the under-surface being moulded, with the letters W.B., the lion and the interior concentric circle recessed, that is intaglio. The transparent moulding is then suitably " masked " and treated, so that only the letters, the lion and the circle are coated with an extremely fine film of metal on the *underside*. Then follows, at will, coloured spraying processes, also on the underside, to produce different coloured effects. As will be seen, the letters and lion appear to stand out stereoscopically as solid-metal forms. The new mouldings are being widely adopted as decoration for motorcars, refrigerators, and it is hoped that it will be applied to radio sets and as dials for clocks, etc.

DOGSBODDY.



Plastics in Modern School Construction

By JOSEPH B. SINGER, B.Sc. (Arch.).

IT has been for some time recognized that traditional materials and methods of construction will fall short of fulfilling the present immense post-war building programme for schools.

Even before the war, school building was below the requirements; damage by enemy action and suspension of all building activities during the war made the existing shortage even more acute. The post-war demand was in excess of the pre-war needs, and the raised standard of accommodation, parallel with the policy of educational reforms, widened the gap.

During the war a committee had been set up by the Board of Education to investigate and recommend alternatives to the traditional methods of school construction. This committee recommended the application of standardized construction and some measure of prefabrication for schools. The advantage of prefabrication is mainly in the great economy achieved by partial assembly in the factory, where conditions are more suitable than on the site.

Prefabrication is a system of construction, which can be particularly successful for buildings on a larger scale, where the planning involves a design of repetitive units. The main criticism of prefabrication is the imposed restriction on the creative ability of designers and difficulty in finding a suitable material that could make a happy compromise of prefabrication with a potentially interesting design. Owing to the educational influence exercised, not only by physical amenities, but also by æsthetics of environment, this aspect of school building should be emphasized.

Apart from the fact that traditional materials were incapable of meeting the immediate post-war needs, it was essential to limit the amount of skilled labour on the site by evolving new and simple techniques of assembly. Standardized planning and construction had to be developed that could, however, lend itself to flexibility in design and large-scale production of units for rapid and economical assembly.

In considering the planning of schools, standards of accommodation remain generally similar for the same type of school; differences are brought about only by architectural treatment and lay-out dictated by the site, orientation, access, etc. The method of construction making use of prefabricated structural units with infilling panels is the most suitable for the requirements of standardized planning. Structural framework has to be erected prior to placing the panels in position. The framework makes it possible to save time by covering the roof while the walls are still in the course of erection.

The choice of an infilling material for walls, partitions, roofs and ceilings has to be in accordance with required properties. Adaptability of the material for variations in the type of panel, to be used for doors, windows, etc., has also to be taken into account. These infillings must have a nominal size based on sub-division of the basic dimensional unit, before the process of standardization can be easily applied. The adoption of the same basic unit in both directions, i.e., in length and width, is envisaged at the earliest stages of design to enable the projection of the school layout in any desired direction.

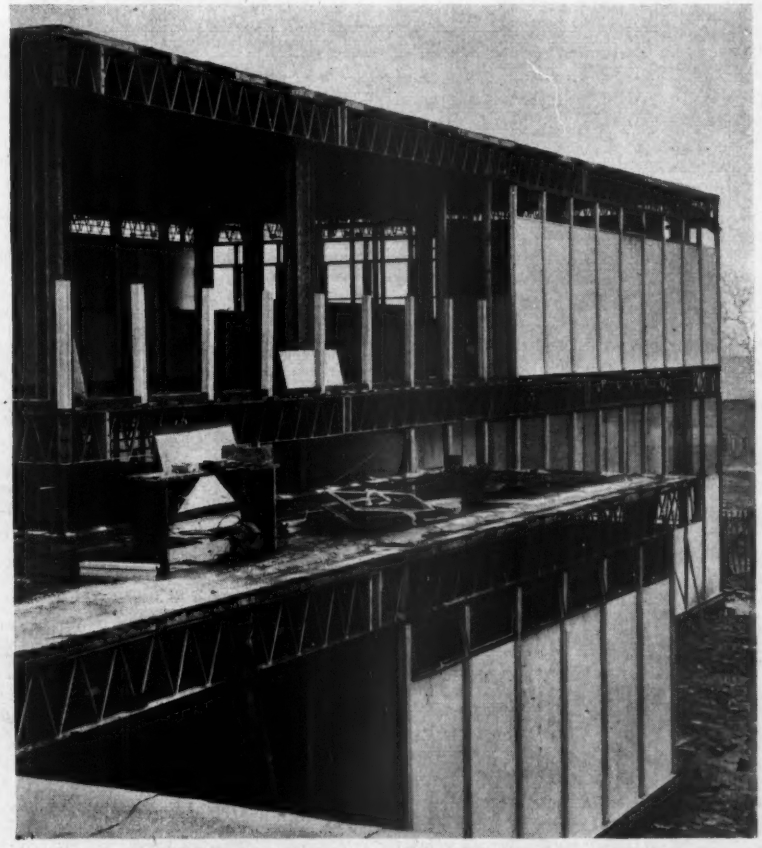


Fig. 1.—General view of two-storey classroom block at Clarendon Secondary School, Oxhey, Herts, during construction, showing use of "Holoplast" panels for external walls and for partitions.

Infilling Panels

Many materials have been used as infilling panels, and among them plastics play an important role, mainly in the form of sandwich laminates. Generally, sandwich laminates consist of high-strength facing sheets with a core of separating ribs or honeycombed structure. Lightness, combined with rigidity of this type of panel, makes its application in building of considerable value.

An interesting prefabricated school, using "Dufaylite" honeycomb material, has been developed by the Building Construction Division of Air Conditioning and Engineering (N.I., Ltd., Northern Ireland). The Northern Ireland Ministry of Education and Air Conditioning and Engineering, Ltd., have jointly erected the first classroom unit prototype at the company's factory at Tradragee, followed by similar buildings elsewhere in Ireland. The squat T-shaped classroom unit with accessory offices has been built on the basis of a grid plan, similar to that used for aluminium schools.

The sandwiched honeycomb panels are interlocked with an aluminium-alloy framework, and the thin sheet materials, which form the skin of the composite

panel, are stabilized by the honeycombed core. The sheets used were resin-bonded wood pulp and asbestos boards for the outer skins and hardboard for the inner skins, in thicknesses from ⅛ in. to ¼ in. Decorative veneers of "Formica" were employed in some positions for facing the hardboards.

In this system of construction, described in the April, 1950, issue of "Plastics" (page 90), plastics are used only as a core of the panel and a facing to inner skins, in some instances. The use of laminated plastics externally and attempts to produce a material of a homogeneous nature, have been the subject of some experiments in the past. It has aimed to produce one material that could serve all the functions of a wall, instead of the common practice of several materials designed for serving one or two purposes.

A new system of prefabrication has now been evolved by Holoplast, Ltd., in conjunction with the Hertfordshire County Council. "Holoplast" laminates, which are well known to-day, reinforced with aluminium structural members, were first used throughout the building in prototype classrooms, forming the first part of the Clarendon Secondary School on the L.C.C. estate at Oxhey.

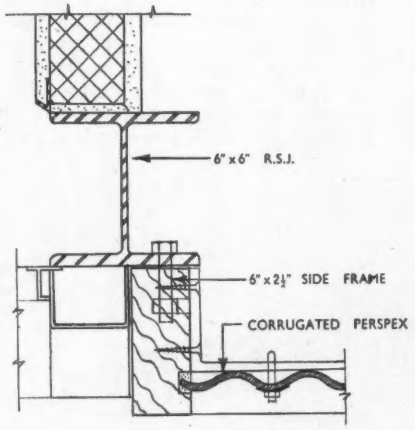
In this school, two-storey classroom blocks have independent frames, designed for a rapid assembly. The framework consists of cruciform-shaped stanchions (4-in. by 4-in. angles) spaced at 10-ft., 13-ft. 4-in., 16-ft. 8-in. and 20-ft. centres. They are mounted on reinforced-concrete pads 3 ft. to 6 ft. 6 ins. square and 1 ft. 10 ins. deep. The stanchions support main lattice beams, on which rest secondary beams at 3-ft. 4-in. centres. Flange thicknesses vary in accordance with the strength required to maintain a constant beam depth and a level ceiling.

The stanchions are spaced on a 40-in. grid, recommended by the Building Societies Association, the Ministry of Health and the Ministry of Education as the most economical, and the standard which allows for a maximum of flexibility in planning and interchangeability of different building components. The concrete site slab is 4½ ins. thick, reinforced with steel fabric.

External walls and partitions are 1 in. thick by 3 ft. 4 ins. wide (nominal size) "Holoplast" panels, and as the standard width of "Holoplast" panels is 4 ft., the remaining 8-in. strips are used for lockers, shelves, w.c. partitions, etc. This plastics material was chosen for infilling panels owing to its damp-proof and thermal insulation properties, and its pleasing appearance. The panels are light, and this facilitates loading, transport and assembly.

New constructional details had to be adopted and a break with traditional methods of building made, due to the narrow section of the panels. This latter feature of the laminate alters the whole approach to the problem of sills, linings and skirting, which are inherent in traditional buildings. The narrow section eliminates some of these problems, but necessitates different constructional details.

The panels were fixed in position by means of aluminium extruded sections and rimmed with mastic tape to prevent water penetration at the joints. The mastic tape was fixed around the edges



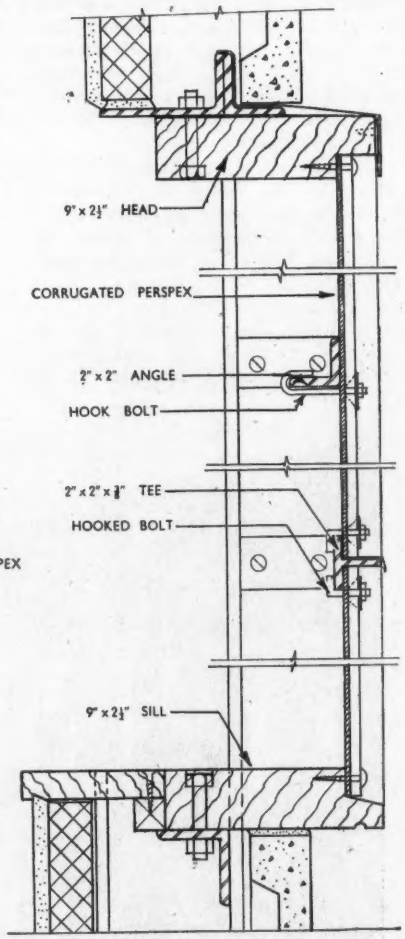


Fig. 3 (above).—Detail of wall panel, incorporating corrugated "Perspex," as used for staircase unit at a school at Stevenage, Herts.

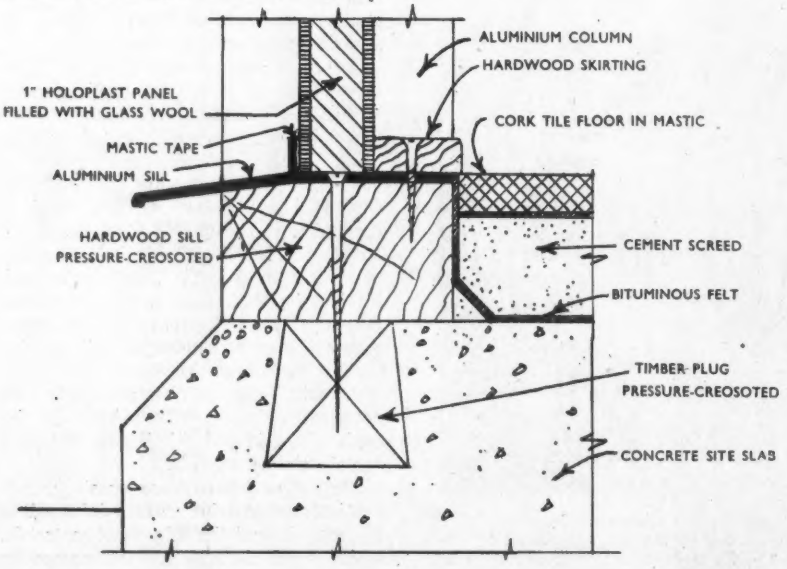


Fig. 2 (left).—Detail for construction of sill at Clarendon Secondary School, Oxhey, Herts.

of the panel and the panels fitted into the extrusions. The clearance between the panel and aluminium was only $\frac{1}{16}$ in., and although the care taken in connection with an accurate insertion of the panel increased the erection time it ensured a tight fit. Both the laminated plastic sheets and aluminium sections are "self-finished" materials, and thus the usual finishing processes associated with traditional building can be left out.

The aluminium sills are fixed to the concrete slab through a hardwood sill (Fig. 2). Packing may be used under the sill, if required, and the sill is screwed to a pressure-creosoted timber plug, cast in the concrete site slab. A flat hardwood skirting is also fixed to the teak sill to cover the joint between the panel and aluminium extrusion, and also the bituminous felt and floor finish. Generally, dry construction involves difficulty in preventing water penetration, and careful detailing of joints is therefore essential. An additional advantage is gained from non-porous materials, as the question of damp walls cannot arise.

External panels were filled with "Fibreglass" for a higher degree of thermal insulation to give the U value of approximately 0.32. Internal panels were filled with sand to improve sound insulation, where it was required. In this prototype school the external face of the panels was painted, but in further buildings that followed, the original brown colour of the panels with stove-enamel finish was replaced by a buff colour incorporated in the process of manufacture.

The construction of the prototype was intended for testing the principles applied, which could be further extended from two-storey to five-storey buildings. The placing of structural members inside the building was criticized on the grounds that a great deal of space was wasted, but it was claimed that the waste was more than compensated by a saving of about 9 ins. in the thickness of external walls and 3-4 ins. on partitions.

Although the laminates have a high resistance to impact, the possibility of some panels being broken necessitated the investigation of means of replacement. The replacement of a damaged panel is quite feasible and should not encounter any difficulty provided it would be slightly narrower, to make possible the easing of a new panel in position without affecting the surrounding structure.

The overall cost of the prototype has shown that basic cost of the plastics and aluminium does not determine the final outcome. It must be also appreciated that a prototype school, which is primarily intended as a means to ascertain the value of new techniques, cannot be economical. The saving was achieved in this system of building, which enabled the erection of panels to be completed within five weeks. The only part of the school built in traditional materials was a brick wall supporting reinforced concrete cantilevered stair treads.

The final cost of the building was 4s. 11d. per cubic foot, which was comparable with an average figure for post-war secondary schools. A further saving was envisaged through the development of a new $1\frac{5}{8}$-in.-thick wall panel. The additional thickness and rigidity would allow the use of lighter aluminium extrusions, and the economy thus achieved was estimated to be about 75 per cent. of the aluminium in the building.

Experience gained from the Oxhey school prototype has served as a means of ascertaining the value of this type of construction and as a basis from which to evolve a superior system of prefabrication.

In the Acton (Middlesex) Technical School extension, the 1-in. panels were superseded by $1\frac{5}{8}$-in. panels and 8-in. by 5-in. reinforced concrete stanchions were placed externally at 8-ft. centres, leaving a continuous flush interior without the usual structural breaks in the wall. In this case the standard 4-ft.-wide panels were jointed at 4-ft. centres. Lattice beams, encased in $\frac{1}{2}$-in. "Holoplast" sheets, were supported on the reinforced concrete stanchions, and the roofing panels finished with bituminous felt. Similar to the previous system of construction, the wall panels were non-load bearing infillings for the framework. Placing of reinforced concrete stanchions externally had the advantage of leaving the internal space free of any obstructions, which is of considerable importance in classrooms.

In the buildings previously described, some delay was experienced through the necessary labour required in cutting the standard panels for window and door frames. The need for a higher degree of prefabrication was quite clear, and the manufacture of completely standardized solid, half-glazed and fully glazed panels was the next step in this development. Special clips for jointing were also employed to facilitate the assembly and erection. In this method, which altered the spacing of panels, two T-shaped 1-in. wide "Holoplast" sections were clipped together.

These improvements were incorporated in other designs, including another Middlesex school. Reinforced concrete columns were in some cases also dispensed with and "Holoplast" panels used to a larger extent as structural members to carry the roof loads.

Glazing

Natural daylighting for classrooms is of utmost importance and an adequately large area of glazing must be always provided. The use of plastics in place of glass is not justified for normal window glazing owing to high price, but some advantages of acrylic resin materials commend them for roof-lights. Art school studios in particular require a well-distributed and shadowless lighting and the problem of north light for optimum working conditions is somewhat similar to that of factories and workshops.

The use of "Perspex" suggests itself for roof lighting, as at the Manchester School of Art. The elimination of special framing, glazing bars and flashing, by matching the corrugations of roofing materials with "Perspex" units, results in economies of construction that are worth consideration. Chequer-board pattern arrangement of "Perspex" units for roofing area ensures the most efficient daylighting.

Light and fresh appearance, and a maximum amount of glazed areas, are associated with contemporary schools; with this end in view transparent wall panels, extending sometimes up to two storeys, are designed. The best example of this type of construction is a "Perspex" wall panel (Fig. 3) in a school at Stevenage, Herts, where the whole two-storey staircase unit is glazed. Corrugated "Perspex" panel with 3-in. corrugations is bedded in mastic and fixed to a wooden frame. The panel is screwed at the top and bottom to the frame, while at the sides it rests in a mastic-filled groove; 2-in. by 2-in. angles with flats welded on ends, screwed to side frames, stiffen the panel at regular intervals by means of hook bolts.

Vertical jointing of "Perspex" sheets is done by overlapping the edges, but for horizontal joints a 2-in. by 2-in. by $\frac{1}{8}$-in. tee is inserted, with turned flange screwed to the side frame. The sheets are fixed with a hooked bolt to the tee, which acts as a glazing bar for the panel. The panel is approximately 8 ft. 3 ins. wide and 20 ft. high.

Miscellaneous Applications

There are numerous applications of plastics in schools, which are fairly well known, i.e., decorative wallpanels, electrical equipment, lighting fittings, and furniture. Polythene waste pipes have potentialities in chemistry laboratories, where they could be directly jointed to earthenware drains running in ducts under the floor.

Low-level flushing tanks have a high casualty rate in schools. Fireclay and cast-iron covers are liable to break when dropped on a hard floor, but the newly designed plastic tanks by Shires and Co., Ltd., have taken this into consideration. The covers of these tanks are $\frac{1}{2}$ in. thick and real violence is needed to break them; in any case, the cover is secured in place by recessed screws. The tanks have a shiny black body, pleasantly contrasting with anodized aluminium beading, flush pipe and chromium-plated handle. Shape and finish are designed for maximum efficiency and hygiene, and concealed fixing solves the problem of brackets.

RULES and SCALES

make use of stability, ease of engraving and good appearance of plastic materials

THE shortage of traditional materials, such as seasoned boxwood and mahogany, originally set manufacturers of mathematical rules on to the problem of finding alternative materials. Several of these have proved so successful that they are permanently superseding wood.

At least four different plastic materials have been selected by Blundell Rules, Ltd., Luton, Beds, for use in high-quality measuring, calculating and drawing instruments. Mathematical slide-rules, previously manufactured from well-seasoned boxwood with lacquered or celluloid surface are now mostly manufactured from a special rigid polyvinyl chloride sheet or from "Perspex." As both of these materials are obtainable in homogeneously white quality, no surface coating is required and the markings may be made directly onto the body of the rule.

The first step in the manufacture of the scales is the preparation of an oversize master scale. This is engraved on metal by a precision dividing machine (Fig. 1). Dies of correct size are then produced by obtaining a photographic reduction of the master scale.

Sheets of the appropriate thermoplastic materials are cut, machined and grooved on a routing machine (Fig. 2) to form blanks of correct shape and size. The blanks are fitted into specially prepared jigs to facilitate these highly accurate machining operations. The prepared blank is then pressed between the heated dies to take the impression of the scale (Fig. 3). To show up the markings on the engraved scale, the whole surface is coated with paint and immediately wiped clean again, leaving clear markings in black or a contrasting colour. Two separate marking colours are frequently used on slide-rules to distinguish different scales. The finished rules are inspected and checked for such things as accuracy of markings and good sliding fit for the moving parts.

Fig. 1.—Preparing an oversize master.

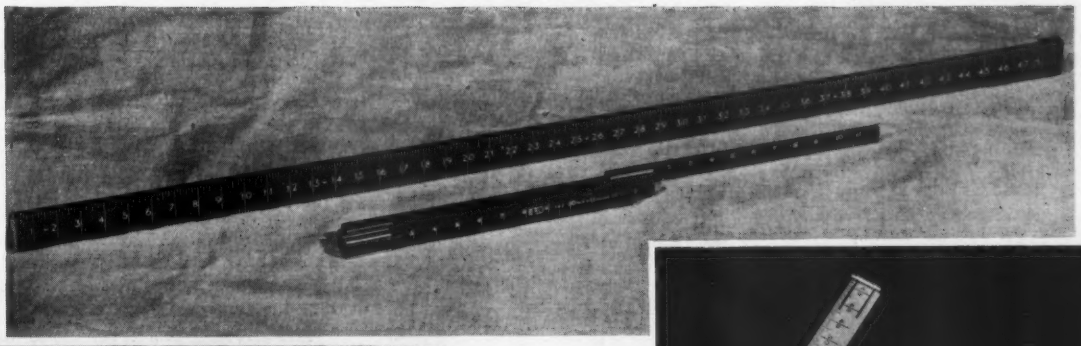
The rigid vinyl sheet used for the manufacture of these instruments was, until some time ago, imported from Germany, but a satisfactory grade of material is now being produced in this country. This material is chosen because it embodies many, if not all, of the properties required in a slide-rule, including linear stability, freedom from water absorption, and permanence of colouring. In addition to these essentials, the material is practically unbreakable, and has both pleasing appearance and "feel." It is also a desirable material from the production aspect, as it takes an excellent engraving.

"Perspex" is also very suitable for instruments and is frequently used for scales, as it has good stability, engraves well, and in thin sections is more rigid than p.v.c. A special "satin" finish produced by Blundell Rules, Ltd., makes it particularly attractive to the eye and to the touch.

Both rigid p.v.c. and "Perspex" have been used for some special-purpose instruments other than the normal rules and scales. A good example of these is the Bilham slide-rule, made in "satin"-finished "Perspex," which is specially designed for meteorological purposes. The scale invented by

Fig. 2.—Machining blanks in special jigs.

Fig. 3.—Engraving scale by heating between dies.



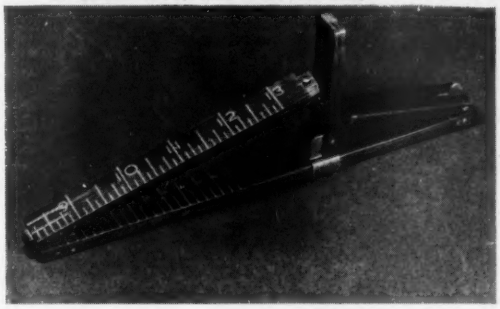


Fig. 4.—Glazier's rod and folding surveyor's rod.

Fig. 5.—"Permali" shoe-size stick.

Fig. 6.—Folding builder's rule.

Mr. Geo. W. Brown, of Borrowash, Derby, for the use of railway engineers is manufactured from the same material. The "Perspex" caliper gauge (Fig. 9) has a scale for special use in the cork trade.

Two other examples of special-purpose measuring instruments are the two shoe-size sticks, one of which is shown. The first is made from extruded polyvinyl chloride strip supplied by Melwood Thermoplastics, Ltd., and is produced for Stephen Lucking, Ltd., of Chester. The smaller folding shoe-size stick (Fig. 5) is made of "Permali" resin-bonded compressed wood laminates (New Insulation Co., Ltd.), and replaces the pre-war boxwood model.

Another material which has been found to have excellent dimensional stability over a wider temperature range than could be expected of thermoplastics is "Bakelite" laminated sheet. Tests undertaken on a 12-in. scale (Fig. 8) by the National Physical Laboratory were described in "Plastics" (1949/March/123). Other instruments made of this material include a 4-ft. glazier's rod, made for the Chandos Tool Co., Ltd., and a telescopic folding surveyor's rod (Fig. 4).

All instruments illustrated are manufactured by Blundell Rules, Ltd., of Luton, Beds. Photographs showing stages of the manufacture of "Perspex" slide-rules were taken by I.C.I., Ltd., Plastics Division.

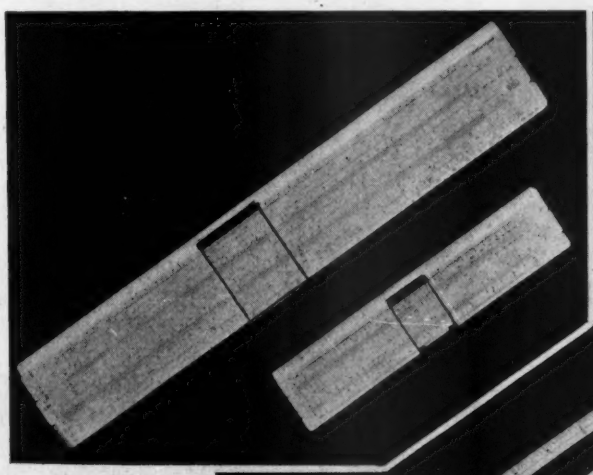


Fig. 7.—Slide-rules in rigid p.v.c.

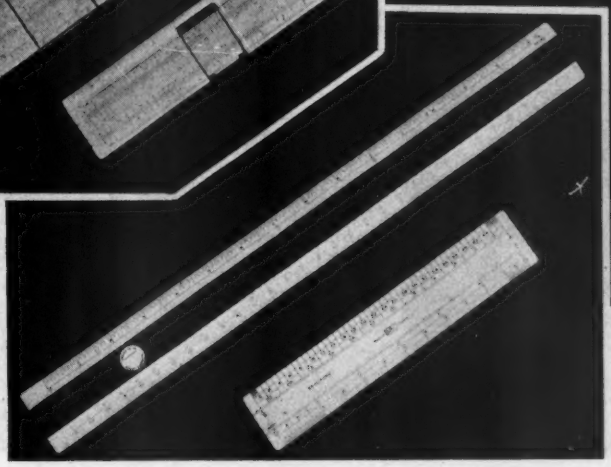


Fig. 8. — Scales in "Bakelite" laminate and "Perspex."

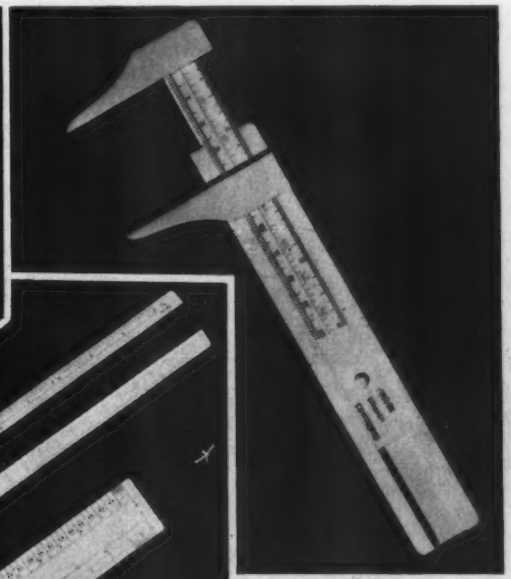


Fig. 9.—"Perspex" caliper gauge.

MODERN TOOL DESIGN

eliminates the necessity of hand unscrewing an internally threaded cup for a vacuum flask

The following notes have been compiled by Universal Tools Ltd., Mitcham, Surrey, who made and designed the tools shown, in collaboration with Plastics Engineers Ltd., Treforest, Glam., who mould the cup for Acme Vacuum Flask Co.

THE plastic vacuum flask cup shown in the accompanying photograph (Fig. 1) does not, at first sight, present any problems to the moulder or the toolmaker, and, in fact, similar cups in thermosetting material have been produced for a considerable time. Their attractive appearance and the fact that they can be handled in comfort whilst containing hot liquids has enabled them largely to supersede the metal pressing which was at one time almost universal despite their somewhat higher manufacturing cost. There are also, of course, several thermoplastic materials which are quite suitable for this duty, but an attempt is to be made to utilize the modern injection moulding machine's high-production rates to the best advantage.

It will at once be apparent that the internal thread necessary in these mouldings presents a major problem, and any tool design which necessitated the unscrewing of the mouldings by hand could be ruled out, because of the excessive increase in the time cycle which was certain to result, the heavy manual effort likely to be needed, and the difficulty of access to the rear cavities on many injection machines.

The first step, therefore, was to modify the original continuous thread to the interrupted form shown in Fig. 1 since, by this slight modification, the difficulties of ejection could be avoided. It was also considered that a stronger article, free from obtrusive weld lines with their associated weakness, could be produced by feeding into the centre of the base of

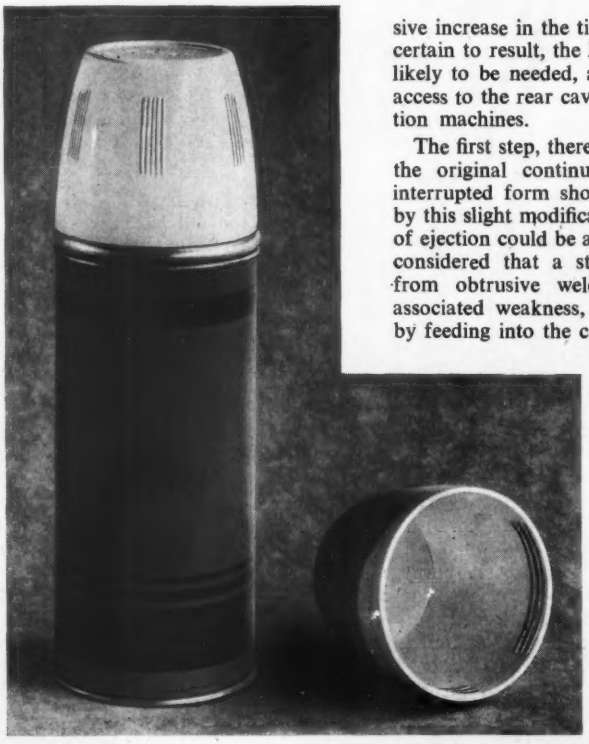


Fig. 1 (left).—The "Acme" vacuum flask, showing cup with its internal interrupted screw-thread.

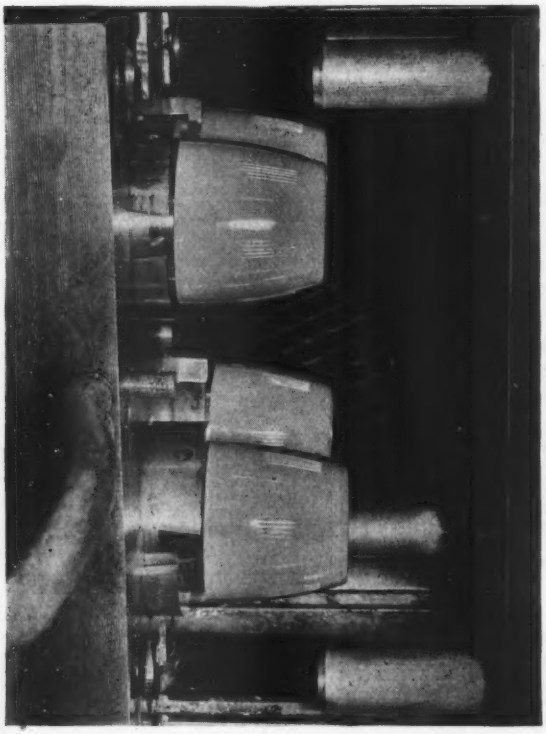


Fig. 2 (left).—The moulded vacuum flask cups as seen prior to removal from male part of mould, after opening the tool.

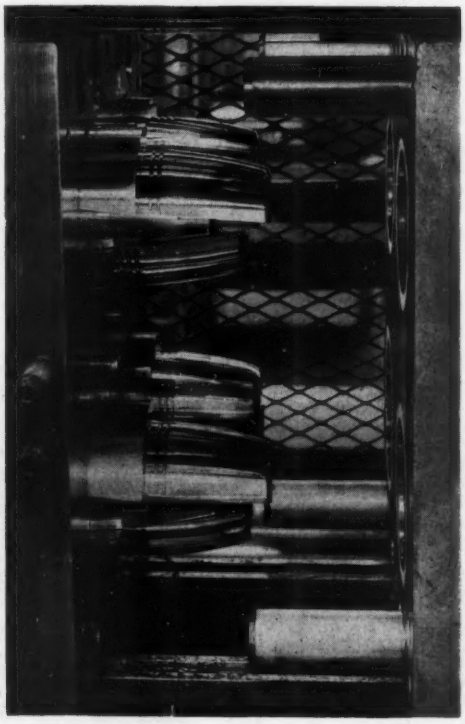


Fig. 3 (right).—The tool (cups removed), ready to be closed for repeating the moulding cycle.

the cup instead of the edge as was at first proposed, and that, if it could be arranged to clip the gates in the tool, a considerable improvement should result in the production time. With these requirements and by close co-operation between the consumer, the moulder and the mould-maker, a mould was designed which in practice has proved extremely satisfactory. It has already produced many thousands of parts, and enables the maximum production rate of the machine to be continuously maintained and, as far as can be judged by appearances, has a life expectation as great as any good-class mould.

The drawing of the tool (Fig. 4) and the various photographs show the method used to avoid any necessity for unscrewing the moulding, but it may not be clear that each core is composed of four pieces, the centre section, which is fixed, and three moving segments which carry the thread (one thread segment has been advanced beyond its normal position in the photographs to show the construction more clearly). In operation, the three segments move up an inclined face on the centre member as they are advanced by the ejection movement, carrying the component forward at the same time. The angle of inclination is so arranged that at the completion of the ejector stroke the thread form is completely extracted and the moulding can be lifted off.

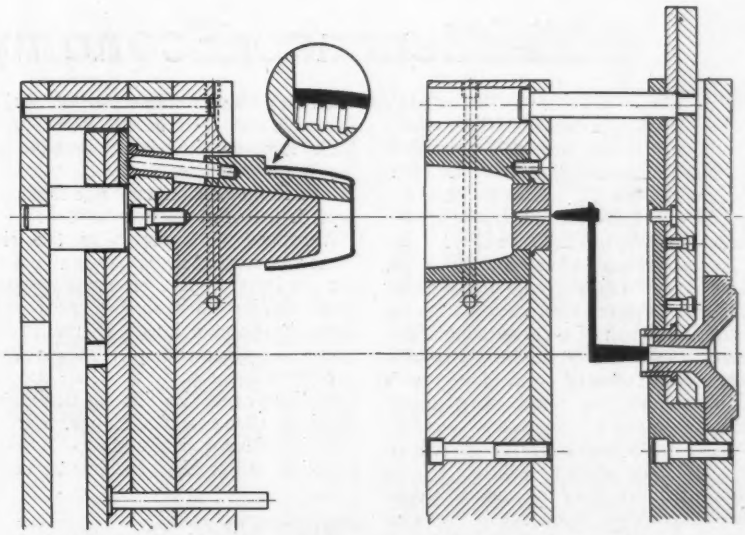


Fig. 4.—Section through 4-impression tool as made by Universal Tools Ltd. for "Acme" vacuum flask cup.

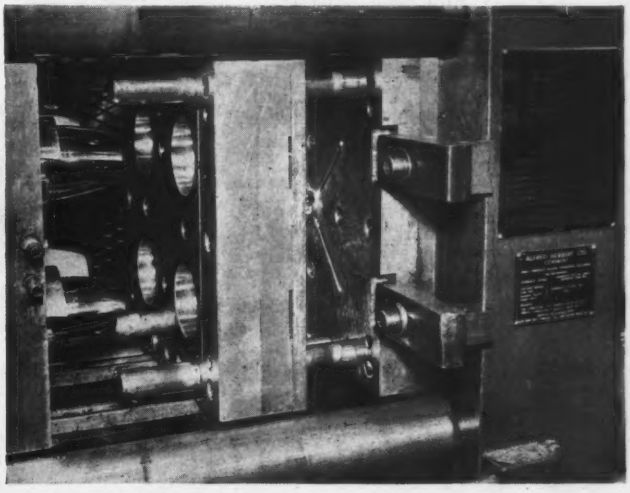


Fig. 5 (above).—General view of 4-impression tool, in fully open position, for moulding "Acme" vacuum flask cup with internal interrupted screw thread.

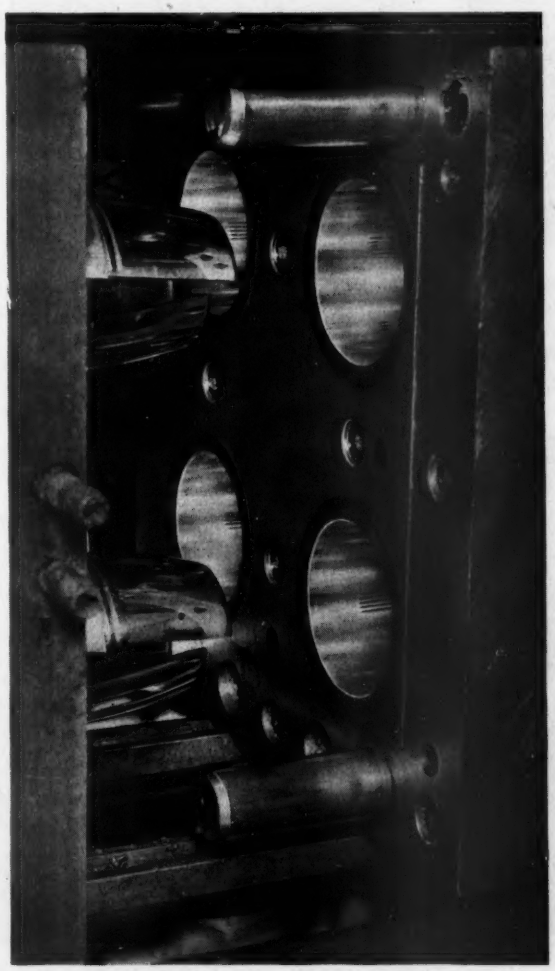


Fig. 6 (left).—Close-up view of tool in fully open position.

It is not claimed that this method of moulding threads is new, but its efficiency, given first-class workmanship in the construction of the tool, is such that it deserves more general adoption than seems to be the case. The method of feeding to the centre of the cavities and to clip the gates in the machine are quite orthodox and will be made clear from the drawing (Fig. 4) and the photographs (Figs. 5 and 6), both of which show the mould in the fully open position.

In the bottom left-hand corner of Fig. 5 will be noted the links which pull forward the cavity plate and actuate the runner ejector gear in the correct sequence.

Maintenance Economy in Ships

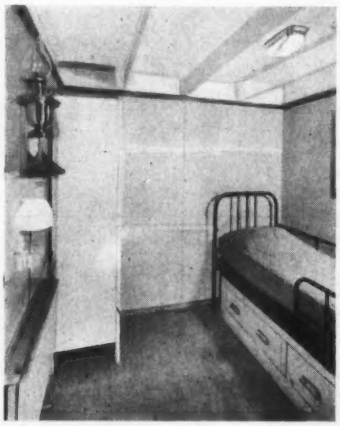
FULL-SCALE replicas of the firemen's mess and of a single-berthed cabin in a modern collier were on view at the Building Centre, Conduit Street, London, throughout January. These replicas, designed by Ralph Gillett, A.R.I.B.A., and based on the B.E.A. colliers S.S. "Charles Parsons" (2,470 tons) and S.S. "Cliff Quay" (4,660 tons), managed by Stephenson Clarke, Ltd., afforded an excellent illustration of the increasing adoption of "Warerite" laminated plastics for lining both officers' and the crew's accommodation in ships, particularly ships of the tonnage indicated.

The S.S. "Charles Parsons," refitted early in 1949 after a collision in the Thames Estuary, gave the managers considerable practical experience of the value of these hardwearing materials for surfacing bulkheads, doors and furniture. It was as a result of this experience that they were used throughout other ships, including the S.S. "Cliff Quay."

Our illustrations show the firemen's mess and the single-berthed cabin. The cabin is panelled in a buff weave pattern, while the mess shows three alternative treatments for wall surfacing—a buff weave from floor to ceiling, a straight contrast of green and grey weave, and a contrast of bird's-eye maple and buff "Finaweave" with a dark dado band. All these illustrate the way in which the employment of light patterns can lend an air of spaciousness to cabins which might otherwise seem confined. "Warerite" materials are also used to surface the flush door, the mess table, and the collapsible table in the cabin.

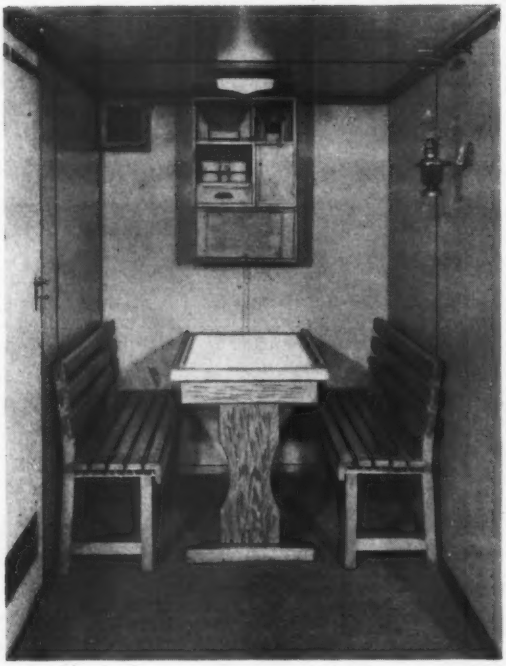
The complete elimination of repainting costs is the outstanding advantage which "Warerite" materials offer the shipowner. Because their patterns and colours are an integral part of a solid plastics sheet with a remarkably hardwearing surface, the only maintenance required to keep them spick and span is a quick rub over with a damp cloth. Under normal conditions of service this plastics surface will last as long as, if not longer than, the ship in which it is installed. It resists cracking and crazing, even under conditions of continued vibration, and does not chip or stain. It stands up to contact with coal, oil and grease, and is highly resistant to steam, moisture and sea air. It is hygienic, is so smooth that it provides no breeding place for germs, resists attack by insects, such as termites, and does not encourage vermin.

In the crew's recreation room on S.S. "Cliff Quay" contrasting shades of red and grey "Warerite" have been adopted for surfacing the walls, table top and writing table; these colours are an integral part of the plastics sheet and are therefore permanent. A pleasing bird's-eye maple pattern has been used for the coat cupboard in the officers' messroom.

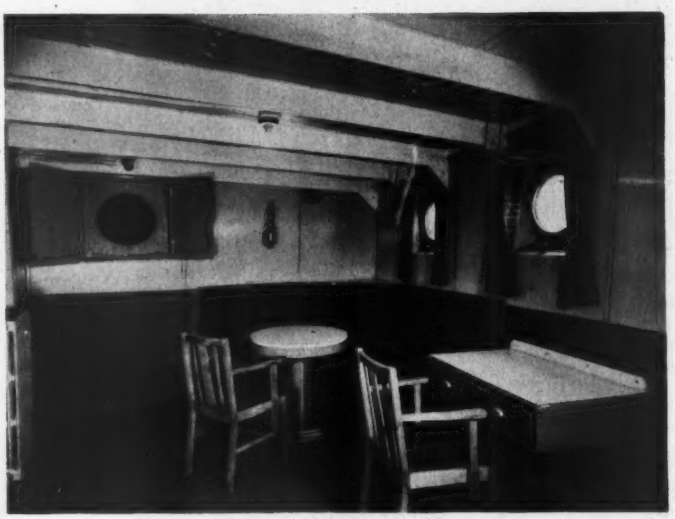


(Above) Single-berthed cabin.

(Right) Coat cupboard fitment in officers' messroom.



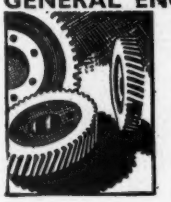
Firemen's mess.



Crew's recreation room.

World's Industry Employs Plastics

GENERAL ENGINEERING



Machining nylon.—Available in rod, slab, hollow cast bushing, strip or tubing in various sizes, it can be machined similar to yellow brass; of course, its thermoplastic nature has to be considered, in particular, frictional heat has to be dissipated. ("Textile World," 1950/Oct./103; " McGraw Hill Digest," 1950/Dec./38.)

Large plastic mouldings.—J. Delmonte states that new developments and increased confidence in plastics as engineering material have resulted in a widespread use for large components. Examples are given of large compression mouldings, large injection mouldings and reinforced plastic mouldings. ("Materials and Methods," 1950/Nov./68.)

Neoprene belting is said to be ideal for almost every kind of light conveying and transmission work. It is manufactured in brown and white by Baldwin Belting Inc., 74-76, Murray Street, New York. (" Materials and Methods," 1950/Nov./102.)

Data on laminated plastics are reviewed by S. C. Churchill. He deals with production of screw threads, dimensions of mouldings, machineability problems and special-purpose materials. (" Mechanical World," 1950/Nov. 17/478.)

Testing thermosetting plastics.—The German Standards Institution has published a draft standard on " flow-time." A sample beaker of 96 mm. length, 74 mm. max. diameter, and 1 mm. wall thickness is proposed, as well as a standard form of mould. This is heated up to 165 degrees C. ± 1 degree for the testing of phenolic materials, and up to 140 degrees C. ±1 degree for aminoplastic materials. (Draft DIN 53465, July, 1950.)

Flash cleaning.—P. H. Winter describes a number of electrically controlled air cylinders adapted to fixtures for the flash cleaning of plastics. (" Tool Engineer," 1950/Oct./37.)

Injection-moulding machine.—A self-contained machine with hydraulic injection, manufactured by Moslo Machinery Co., 2443, Prospect Avenue, Cleveland 15, Ohio, moulds all thermoplastics, including nylon. When thermoplastics and nylon have to be treated together, a stainless-steel cylinder, torpedo, filter and nozzle with nose heater is recommended. (" Machine and Tool Blue Book," 1950/Dec./297.)

Testing metal quality through models.—Plastic scale models of machine parts and tools examined under polarized light enables engineers to obtain a picture of strain distribution. The material is cast in blocks 8 ins. wide and 36 ins. long. (" Chem. Eng. News," 1950/Oct. 23/371.)

ELECTRICAL

Embedding resins.—The Nat. Bureau Standards casting resin is most suitable for potting certain types of electronic circuits. The development, uses and properties of the resin are surveyed. (Nat. Bureau of Standards, Circular 493, May 22, 1950.)

A nylon plug body for a neon glow lamp, serving as a pilot light, is intended to stand rough usage. (" Product Engineering," 1950/Aug./187.)

Heat-resistant plastic foils.—The German Standards Institution has issued recommendations for the use of heat-resistant plastic foils in electrical machinery. These are very detailed and deal with the testing of individual samples and with the general character of foils which have not yet been sufficiently tested. (DIN 57345, July, 1950.)

Insulated screws for electrical equipment.—B. G. Forman describes new designs of plastic-insulated fasteners. They consist of a serrated metal-core extrusion coated with a plastic exterior to form a composite rod. Final machining is on an automatic screw machine. (" Product Engineering," 1950/Sep./106.)

Neoprene-jacketed telephone wires.—In a paper presented to the Wire Association Convention, C. C. Lawson referred to the general adaptation during the past five years of neoprene jacket instead of weatherproofed cotton braids for outdoor distributing wires in telephone plants. (" Wire and Wire Products," 1950/Oct./829.)

MISCELLANEOUS

Threaded plastic pipes are supplied by Carbon Prod. Corp., 10235, Meech Avenue, Cleveland 5, in lengths up to 20 ft. with standard plastic pipe fittings and threads. Special features are the great lightness of the pipes, which can handle gases and fluids of all types. (" Materials and Methods," 1950/Nov./102.)

T.V. colour disc is made of cellulose acetate plastic sheeting consisting of the three primary colours, red, blue and green. This disc is included in converter kit for producing T.V. in colour for 6-in. pictures until 12-in. converters are available. (" Product Engineering," 1950/Nov./165.)

Silicone putty glides.—Wobble of cabinet legs due to uneven floors is automatically stopped by self-adjusting glides. They are supplied in several sizes to withstand weights from 10 lb. to 1 ton (Ever Level Inc., New York 12, N.Y.). (" Product Engineering," 1950/Nov./180.)

Silicones for extreme temperatures.—Gaskets, sleeves, washers, seals, tubing and other moulded, extruded, punched and lathe or die-cut rubber parts can be supplied in quantity, fabricated from the new silicone 161 rubber compound (Stalwart Rubber Co., 166, Northfield Road, Bedford, Ohio). (" Product Engineering," 1950/Nov./192.)

Synthetic rubbers and elasto-plastics.—J. A. Buck gives a survey of the rubber-like synthetics and refers in particular to the development of fluoroethylene plastics promising great advances in heat- and chemical-resistant packing and jointing materials. (" Mechanical World," 1950/Dec. 1/511.)

Flamepolishing of plastics.—K. Krekeler, Aachen, investigated this operation and found the following optimum conditions for " Plexiglas ": Torch jet diameter, 0.5 to 1 mm.; gas pressure, oxygen 1.5 kg./sq. cm., acetylene 0.08 to 0.1 kg./sq. cm.; torch distance, 50 to 60 mm.; torch feed, 10 to 12 m/min. The surface should be smoothed by scraping. (" Kunststoffe," 1950/June/194.)

Plastics at the " Achema."—The first post-war " Achema " showed a large display of plastics for the chemical industries. A detailed report deals with raw materials, semi-finished and finished products of thermosetting and thermoplastic resins, plastic floor cements, lacquers, filter materials, machines for the plastics industry, testing and measuring apparatus. (" Kunststoffe," 1950/Sep./290-293.)

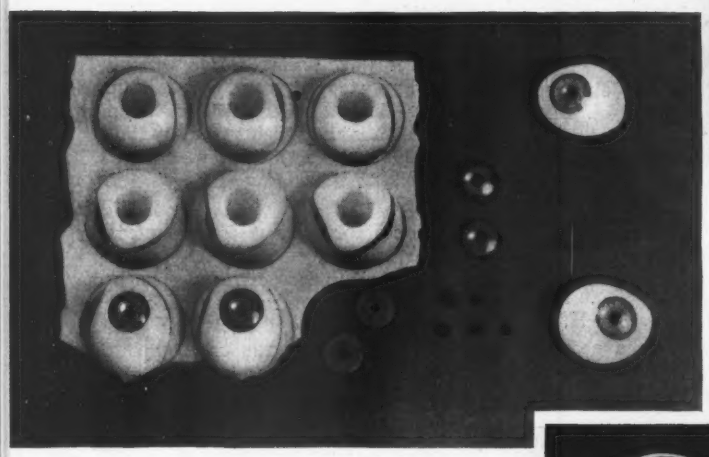
Injection moulding of transparent and lightly coloured parts of polystyrene.—A. Schmidt reviews his experiences in the treatment of this material and, to prevent dusting owing to the electrostatic charging of the powder, recommends that the mass flows without stoppage, to prevent burning, and to use highly polished moulds. (" Kunststoffe," 1950/Sep./281.)

Hot-gas welding of plastics.—A short article gives a general survey on this technique. (" Machine," 1950/Sep./703.)

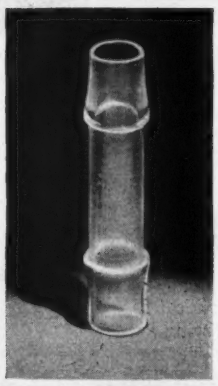
PLASTICS
IN THE SERVICE OF MAN

A pictorial review of high-quality units moulded or otherwise fabricated in Great Britain . . .

16. Medical and Dental Applications

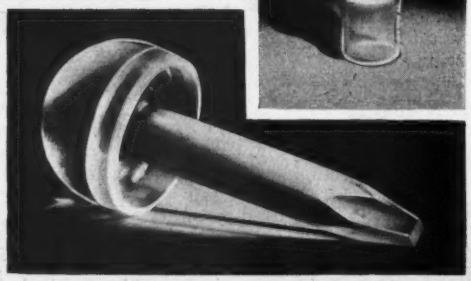


(Above) Stages in the manufacture of acrylic artificial eyes by Portland Plastics, Ltd. Eye-balls—eight are shown still attached to the "flash"—and hand-painted irises are moulded separately, fitted together and completed by moulding again to give a clear transparent surface.

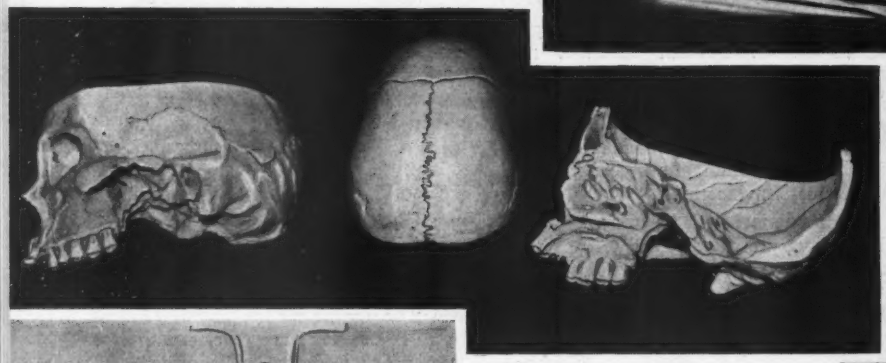


(Above) Acrylic contact lenses offer aesthetic and frequently also ophthalmic advantages over normal spectacles. The illustration shows stages in the preparation of lenses as made by Obrig Laboratories (Great Britain) Ltd.

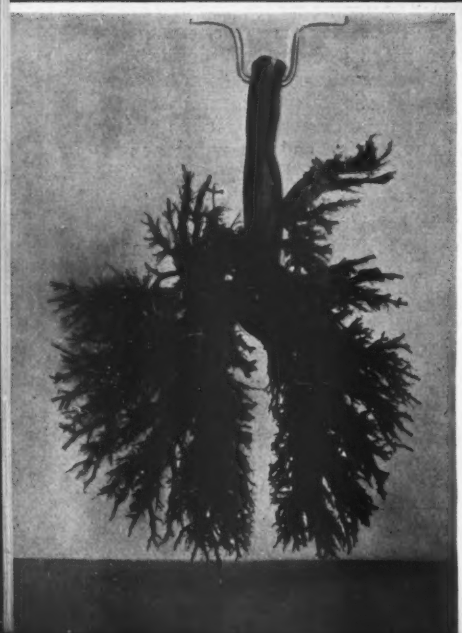
(Left) Acrylic blood-vessel connector made by Portland Plastics, Ltd., gives temporary passage for blood in cases of injury while the natural blood-vessels adapt themselves to changed conditions.



(Left) D'Aubergné-Judet artificial femoral head, made of acrylic material and supplied in this country by Medical Supply Association, Ltd.



(Above and right) Exact replicas of the whole human skeleton are cast from acrylic materials in flexible moulds by Educational and Scientific Plastics Ltd. Besides overcoming the difficulty of natural supplies, the acrylic bone models are washable and more durable than natural bone.



(Left) This demonstration model of a sheep's lung was made at the Plastics Research Laboratory of the Royal National Orthopædic Hospital, Stanmore, by injecting coloured "Marco" polyester resins (Scott, Bader and Co., Ltd.) into the lung and curing to form a solid cast.

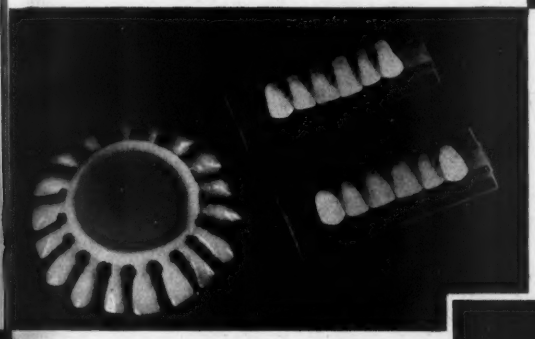
(Above) Denture bases and prostheses manufactured from "Kallodent" acrylic material (I.C.I. Ltd., Plastics Division).

(Right) The "Plastal" Schnee baths fabricated from transparent "Perspex" are supplied by Medical Supply Association Ltd. for use in electrical physiotherapy treatment.

(Right) Artificial hand cast from "Welvic" p.v.c. paste by I.C.I. Ltd., Plastics Division.

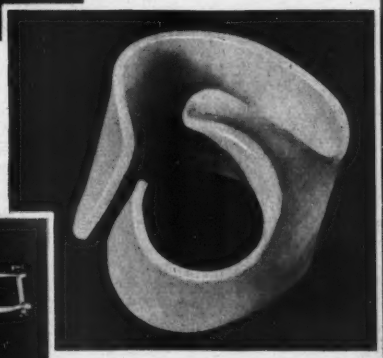
(Left) Shade guide for "Dentafil" acrylic material for dental fillings, produced by Dental Fillings, Ltd.

(Below) Novel "Minipac" dispenser for denture fixative moulded in cellulose acetate or polystyrene by Cascelloid Ltd. for Dentesive Ltd.

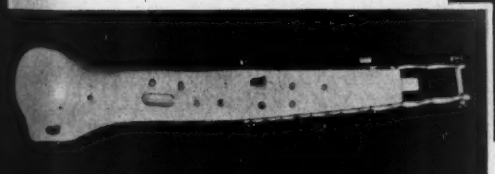


(Below) Opponens splint for thumb, shaped from polyvinyl chloride-polyvinyl acetate copolymer sheet (BX Plastics, Ltd.), by the Royal National Orthopædic Hospital ("Plastics," 1948/July/352).

(Above) Acrylic artificial teeth manufactured by Portland Plastics, Ltd., shown mounted, and on "daisy" of teeth as it emerges from the mould.

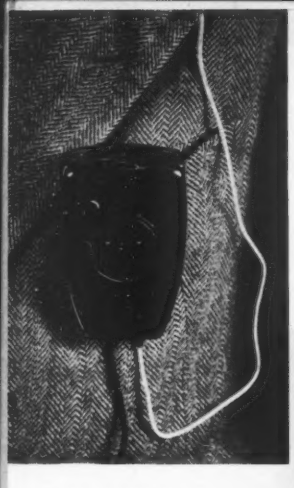


(Left) Hip spica moulded from "Durestos" (Turner Brothers Asbestos Co. Ltd.) by the Plastics Research Unit of the Royal National Orthopædic Hospital.



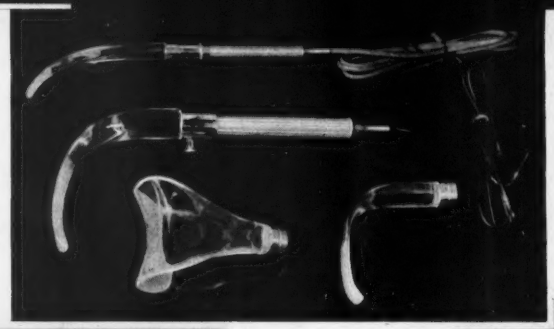
(Above and left) The Alkathene (I.C.I. Ltd.) replica of a humerus (above) was moulded by the Plastics Research Unit of the Royal National Orthopædic Hospital, Stanmore, and inserted into the arm of a patient (left).

(Left and right) This polythene jacket moulded from Alkathene (I.C.I. Ltd.), used for the treatment of scoliosis, is another development made at the Royal National Orthopædic Hospital.

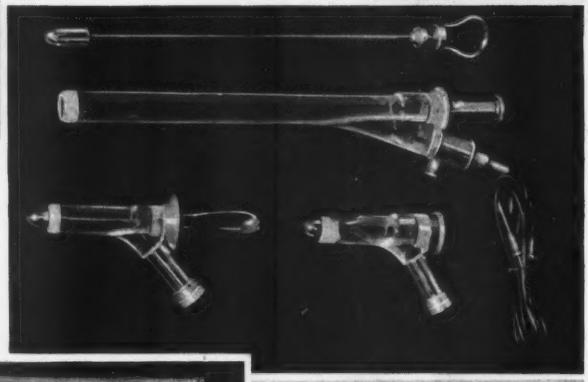


(Left) The case of the "Medresco" hearing aid is moulded in Bakelite phenolic material by Kent Mouldings. Internal components are mounted on Bakelite laminated sheet. (Photo : Bakelite, Ltd.)

(Right) Surgical retractors, fabricated from "Perspex" by Vann Brothers, make use of the "light piping" properties of this material. (Photo: I.C.I., Ltd.)

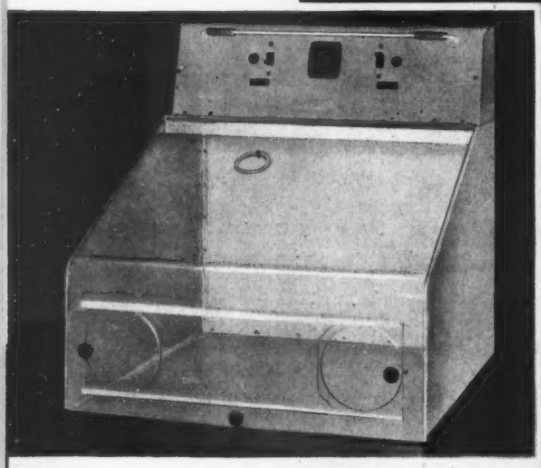


(Below) The "Helvin" stethoscope, made by Hellerman Electric, Ltd., with tubing and chest piece made in one piece of flexible p.v.c., is claimed to have excellent acoustic properties.

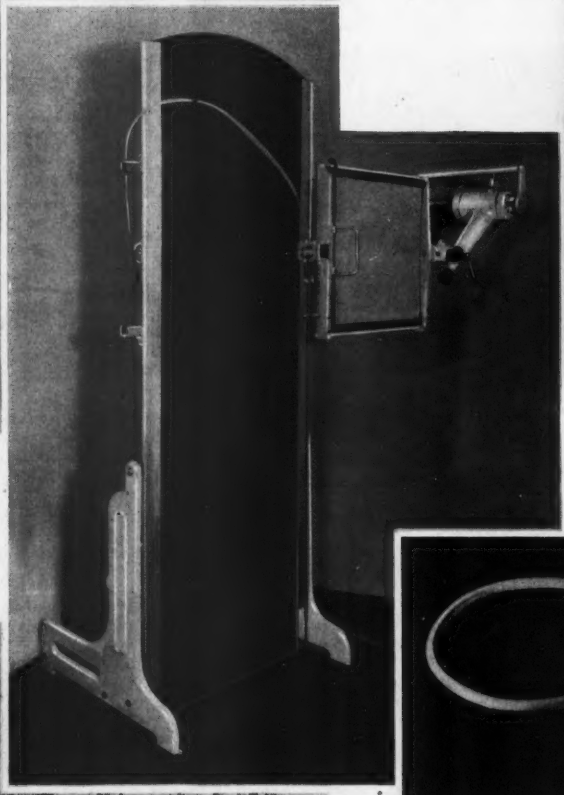


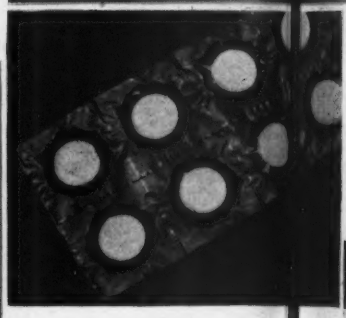
(Left) Another group of instruments manufactured by Vann Brothers from clear "Perspex" includes a sigmoidoscope, operating proctoscope and vaginoscope (Photo : I.C.I., Ltd.)

(Below) A shaped "Perspex" front with two arm-holes gives a clear view for the pharmacist operating the sterile dispensing cabinet manufactured by Hanovia, Ltd.



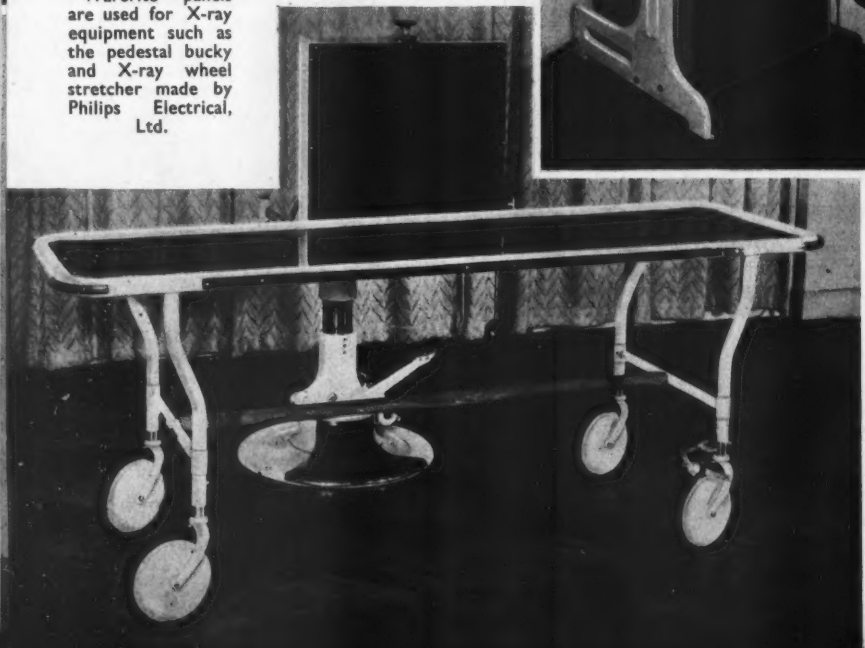
(Right) A "Warerite" panel with low X-ray absorption and uniform opacity is employed in the "G.R." Orthoscope manufactured by General Radiological, Ltd. (Photo : Warerite, Ltd.)

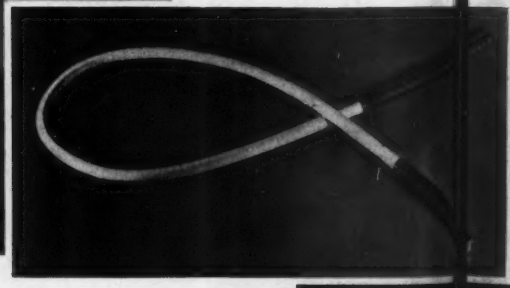




(Above) These pharmaceutical tablets, individually sealed between two sheets of cellulose film, are packed by Ivers-Lee (Gt. Britain) Ltd.

(Below) Similar "Warerite" panels are used for X-ray equipment such as the pedestal bucky and X-ray wheel stretcher made by Philips Electrical, Ltd.





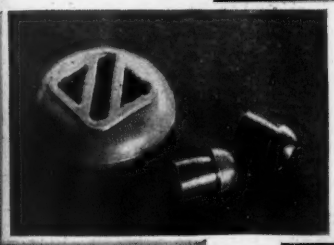
(Above) For good appearance and ease of cleaning the flexible dentist drill has been covered with soft p.v.c. by Creators, Ltd. The ends are covered by tubes of rigid p.v.c.

(Right) The "Fulfield" applicator (Medical Supply Association Ltd.) with head fabricated from transparent "Perspex" is used to localize the beam of radiation in deep X-ray therapy.

(Right) "Dalzoflex" elastic strapping is manufactured by Dalmas Ltd. and hygienically packed in a box specially moulded of pink polystyrene.

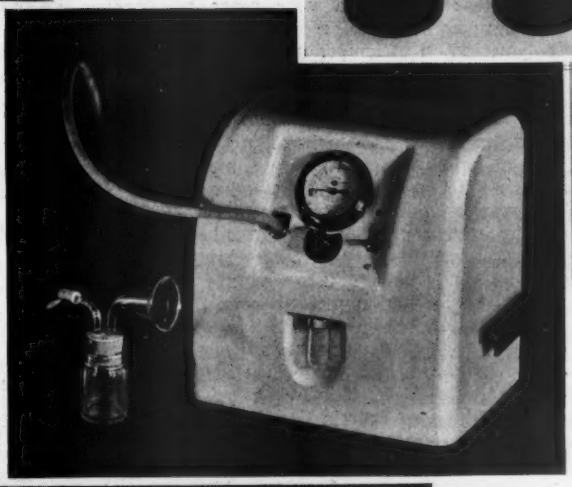
(Right) The "Surqualet" electric syringe sterilizer (Surgical Equipments Supplies Ltd.) incorporates a jacket and lid knob moulded from "Beetle" melamine moulding powder (Photo: B.I.P., Ltd.)

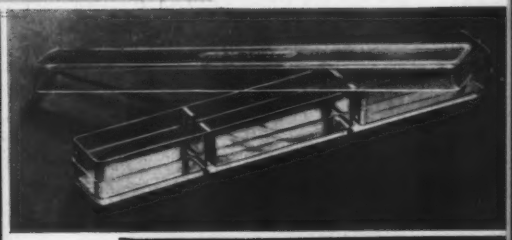
(Below) This black case for a surgical syringe was moulded in phenolic material by Universal Metal Products, Ltd., for Surgical Equipment Supplies, Ltd. ("Plastics," 1950, March, 79.)



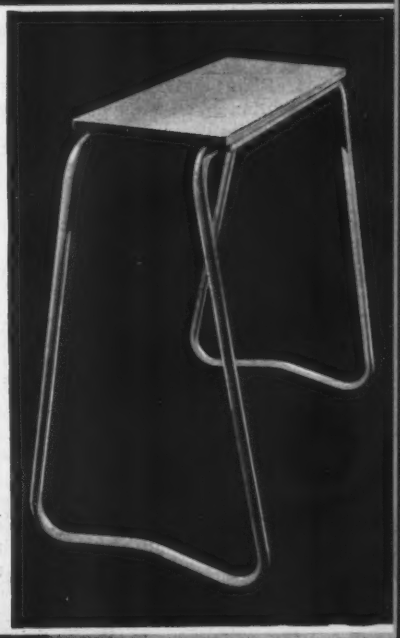
(Left) Microphone shroud for a deaf aid set and ear pieces for the National Health Service Hearing Aid are both moulded in soft p.v.c. by Hellerman Electric, Ltd.

(Below) This injection moulded polystyrene box for a surgeon's knife was moulded for John Weiss and Son, Ltd., by Universal Metal Products, Ltd.

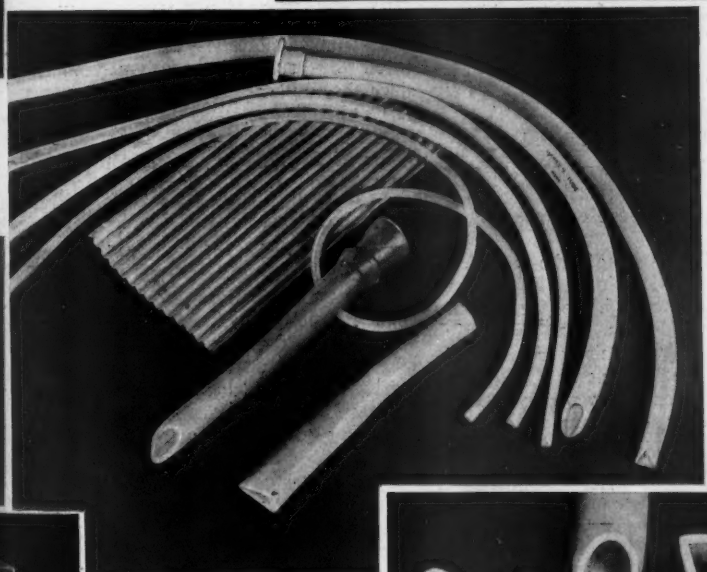


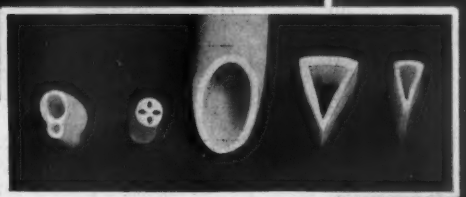


(Right) The "Emesay" breast pump manufactured by Medical Supply Association, Ltd., is housed in a one-piece shaping of "Perspex." ("Plastics," 1949/Apr./174.)



(Right) "Celastoid" tubing over metal give the legs of this overbed table, made by Porter Products (London), Ltd., a pleasant, smooth, hard-wearing and washable surface. (Photo: British Celanese, Ltd.)





(Above) The catheters, larynx tubes and other tubes for medical purposes, are extruded by Portland Plastics Ltd. from special vinyl polymers. Polythene is used for the draining sheet and the prostheses in the foreground.

(Right) A hard-wearing washable surface makes "Warerite" a suitable material for the surface of this overbed table manufactured by Hoskins and Sewell, Ltd. (Photo: Warerite, Ltd.)

Polymers at the Chemical Research Laboratory

ACCORDING to the Report of the Director of the Chemical Research Laboratory, Teddington, for 1949 ("Chemistry Research, 1949," H.M. Stationery Office, price 3s.), the High Polymers and Plastics Section of the Laboratory is now engaged on two main topics, the study of ion-exchange resins, and the relationship between the properties and chain-length of carefully fractionated linear polymers. Fundamental studies of ion-exchange resins, carried out by the Laboratory in collaboration with the Low Temperature Research Station of the D.S.I.R. show that the more basic amino acids may be separated by displacement development from a column of sulphonated polystyrene of low degree of cross-linking.

Some work on the polymers and copolymers of acenaphthylene has been carried out by the Organic Group of the Laboratory.

Polymers and Copolymers of Acenaphthylene

It has previously been shown that a substantial elevation in the softening point of polystyrene can be brought about by the copolymerization of styrene with acenaphthylene. The following data show that this is achieved with no significant change in the electrical properties of the polymer.

A series of copolymers of styrene and acenaphthylene in the form of moulded discs 53 mm. diameter by 1 mm. thick was prepared and submitted to the Electricity Division, National Physical Laboratory, for electrical tests. Some of the copolymers were moulded directly from the products of thermal polymerization these contained small amounts of unchanged monomers. The purified copolymers were obtained by precipitation of the products of thermal and emulsion polymerization from benzene solution by excess methanol. In Table 1 the composition of the copolymers is expressed in terms of the relative proportions of the monomers in the initial monomer mixtures.

Still higher softening points can be attained by incorporating greater proportions of acenaphthylene in the copolymers, but there is a marked deterioration in mechanical properties. For this reason, copolymerization of acenaphthylene with monomers, other than styrene, which are likely to give less rigid polymer chain structures has been explored. A series of copolymers with isobutylene covering a wide range of molar ratios has been prepared by ionic polymerization at temperatures down to −105 degrees C. with Friedel-Crafts catalysts (boron trifluoride, aluminium chloride). The products vary from hard brittle resins through high-melting wax-like materials to soft rubbery compositions as the proportion of isobutylene is increased. Resins with good flow properties in the range 200-250 degrees have been obtained but they were very brittle. In most cases the products were not of a very high order in molecular weight. The difference in the carbon-hydrogen ratios for the two monomers permits determination of the composition of the final copolymers by ultimate analysis.

A preliminary examination has been made of the emulsion polymerization of acenaphthylene and butadiene. The yields of copolymers so far obtained have been low. A copolymer with a molar composition approximating to 1 acenaphthylene : 2 butadiene was a resin which could be moulded at 145 degrees.

Derivatives of Polyvinyl Chloride

In the High Polymers and Plastics section the chemical reactivity of substituent groups has been engaging attention.

A general survey of the reaction between polyvinyl chloride and other halogen-containing high polymers with ammonia and amines has previously been reported ("Chemistry Research," 1948, p. 54). The products were insoluble, contained nitrogen and were potentially of value as anion-exchange resins. In the period under review, the reaction of polyvinyl chloride with methylamine and ethylene diamine has been examined in detail with the objective of elucidating the mechanism of reaction. The experimental method was to react 1 g. samples of polymer with amine in sealed tubes; after isolation and purification, the products were analysed for nitrogen and chlorine. In this manner curves relating per cent. nitrogen and per cent. chlorine with reaction time were obtained and hence the relationship between the nitrogen and chlorine contents could be derived.

Sulphonated Crosslinked Polystyrene

A study is being made of the effect of systematic variations in polymer structure, in particular, degree of crosslinking, on certain fundamental properties of ion-exchange resins. Polystyrene, crosslinked with divinyl benzene and after-sulphonated, is well suited for this work, in that the product is mono-functional and of well-defined chemical constitution; further, the degree of crosslinking of the polystyrene can be controlled and independently assessed. Bead polymers containing different amounts of divinyl benzene have been made and sulphonated; preliminary examination of the swelling of the products and of the exchange rates of simple ions is given in the complete report.

Crosslinked polystyrene has been prepared by suspension polymerization, since the resulting bead polymer is very easily handled during the subsequent sulphonation process and the spherical shape of the final product is convenient for rate studies.

Styrene, divinyl benzene and catalyst are shaken at room temperature with an aqueous dispersion of "Promulsin" (a cellulosic derivative). The monomer phase disperses in the weak gel, forming spherical globules which are sufficiently stable to allow polymerization to be effected at 80 degrees without further agitation. The product, after removal of "Promulsin" by acid hydrolysis and washing consist of regular spheres. Compared with techniques which require stirring during polymerization, this process is more easily controlled and more readily applicable to low boiling monomers.

The particle-size distribution of the product is controlled mainly by the viscosity of the "Promulsin" dispersion and by the energy supplied in shaking. Solutions of high viscosity are required to stabilize small particles and in consequence vigorous shaking is needed to disperse the monomers initially. Thus particles of diameter 100 to 500μ are readily stabilized and dispersed in solutions containing 1 per cent. to 1.75 per

Table 1.—Copolymers of Styrene and Acenaphthylene

Composition of copolymer		Type of polymer	% Polymer	Softening point °C.	Frequency	Permittivity	Power factor
% Styrene	% Acenaphthylene						
90	10	Crude Thermal (120°)	94	87-98°	1 kc/s	2·62	0·0[illegible]2
					1 Mc/s	2·62	0·[illegible]05
90	10	Purified Thermal (120°)	100	114°	1 kc/s	2·62	0·0002
					1 Mc/s	2·62	0·[illegible]4
80	20	Crude Thermal (120°)	89·5	93°	1 kc/s	2·64	0·00 3
					1 Mc/s	2·64	0·0005
80	20	Purified Thermal (120°)	100	—	1 kc/s	2·64	0·0 03
					1 Mc/s	2·64	0·[illegible]4
80	20	Purified Emulsion (60°)	100	134°	1 kc/s	2·63	0·00 2
					1 Mc/s	2·63	0·[illegible]15
70	30	Purified Emulsion (60°)	100	—	1 kc/s	2·63	0·00[illegible]2
					1 Mc/s	2·63	0·0006

Table 2—Comparison of metal pretreatments with different adhesives. Failing loads in lb. for lap joints to D.T.D. 775 in aluminium-clad aluminium alloy 1 in. wide × ½ in. overlap 20 s.w.g.

Adhesive	Bonding pressure (p.s.i.)	Chromic-sulphuric acid pickle				Abrasion with carborundum 120			
		No. of Joints	Mean joint strength	Standard deviation	% Metal failures	No. of Joints	Mean joint strength	Standard deviation	% Metal failures
FF (cold-setting resorcinol-formaldehyde)	50	10	1,250	90	nil	10	600	50	nil
GA (hot-setting phenol-formaldehyde—polyvinyl acetate)	50	55	1,400	220	nil	115	1,600	60	nil
"Redux" (hot-setting phenol-formaldehyde—polyvinyl formal)	50	10	2,200	50	60	10	1 700	100	nil
"Redux" (as above)	200	35	2,250	70	60	30	1,950	120	nil
"Araldite" (hot setting)	10	10	2,150	50	100	10	1,900	70	nil

cent. "Promulsin," but a concentration of about 3 per cent., with very vigorous shaking, is required to produce a good yield of particles less than 50μ in diameter. By adjusting the conditions, any particle size likely to be needed in ion-exchange applications can now be made in reasonable yield.

Monomer mixtures of styrene and divinyl benzene, containing nominally 2 per cent., 3 per cent., 4 per cent., 5 per cent., 10 per cent., 17 per cent. and 33 per cent. divinyl benzene, have been polymerized. The yield of copolymer decreases with increasing divinyl benzene content, but the particle-size distribution is unaffected. Sulphonation has been effected by heating bead polymer with excess concentrated sulphuric acid at 100 degrees in presence of 1 per cent. silver sulphate.

A surface sulphonated bead polymer of diameter less than 50μ has been made and supplied to the Atomic Energy Research Establishment at Harwell for a special investigation. Sulphonated crosslinked polystyrene behaves as a hygroscopic swelling gel, possessing a moisture regain at saturation of 50-300 per cent. depending on the degree of crosslinking. A volume shrinkage, due to desorption, is observed when the concentration of ambient solution is increased; volume changes are also observed when the nature of the cation is changed. A knowledge of the magnitude of these changes is desirable from the practical standpoint. Of greater importance, swelling effects serve as a criterion of the degree of crosslinking of the polymer network.

A monofunctional weakly acidic resin has been prepared by co-polymerization of methacrylic acid and divinyl benzene. This work has been described in a communication to the Faraday Society.

Glues for Light Alloys

Previous work with a hot-setting adhesive, consisting of polyvinyl acetate and a phenolic resin, indicated that more reproducible joint strengths were obtained by mild abrasion of the metal surfaces prior to gluing than by chemical pretreatment with a chromic-sulphuric acid pickle. The results for GA (hot-setting phenol formaldehyde-polyvinyl acetate) adhesive in Table 2 illustrate the improvement obtained. This table shows that although abrasion gives more reproducible results with GA, the pickle treatment gives higher average joint strength and lower scatter with the other adhesives. It is clear, however, that the behaviour of GA is not typical and it would be essential in an investigation of the effect of surface condition to examine several types of adhesives.

Although there is little possibilty of the abrasion treatment being generally adopted in preference to the existing chemical process, it may prove quicker or more convenient in certain applications. It is more effective than simple degreasing treatments with solvents.

LETTERS TO THE EDITOR

Screw-cap Containers

SIR,—We have an inquiry for 200 dozen plastic containers with screw cap, length 8 cm., diameter 3½ cm. We shall be pleased to be put in touch with any suppliers of this particular type of container.

FRASER, ROBERTS AND CO.

75, Clarendon Road,
Watford, Herts.

Bouncing Putty

Sir,—We shall be obliged if you can give us any technical information about a new material known as "crazy putty" or "bouncing putty," mentioned in several papers as a product of the General Electric Co. of America. It is sold in America as a plaything; you can bend it, twist it, break it in pieces, join it together again, and bounce it like a rubber ball.

BLUE STAR PLASTIC PRODUCTS, LTD.

Victoria House,
Bath Lane, Newcastle-on-Tyne, 1.

[EDITOR'S NOTE: This material is one of the silicone resins; as "bouncing putty" it has been in existence in America for some three or four years. However, it is so costly and so valuable for high-temperature electrical jobs that we do not think manufacturers would worry about putting it on the market in this country as a toy. The only suppliers of silicone resins in this country are Albright and Wilson, Ltd., 49, Park Lane, London, W.1.]

Drawer Knobs

SIR,—Can you please put us in touch with a manufacturer who can supply 3,000 1-in or 1½-in. plain ball clear "Perspex" drawer knobs?

I. WARSHAW AND SON, LTD.

319-321, Old Street, E.C.1.

Luminous Pigments

Sir,—We understand that the new luminous pigments used on advertisements and newspaper posters are plastics in nature. Can you give us any details?

"X.Y.Z."

[EDITOR'S NOTE: The "pigments" themselves are not "plastics," but fluorescent dyestuffs. They are, however, dissolved in an unpolymerized resin (methyl methacrylate, melamine formaldehyde, etc.) which, on polymerization or condensation, results in a transparent solid, and are then made into solutions suitable for ink-manufacture for silk-screen printing. The inks are of American manufacture (see U.S.P. 2,498,592).]

Reinforced Plastics Hose

SIR,—We are seeking a source of supply for ½-in. internal-diameter flexible gas and oil hose, which will be suitable for use at −67 degrees F. We understand that plastics hose with a wire core, manufactured in England, meets this specification. Trade names given us are "Petriflex" and "Superflexite." We will appreciate the addresses of sources of supply, and 12 to 18-in. samples, with complete information and prices.

MACDONALD BROS. AIRCRAFT, LTD.
SUPPLY DIVISION.

104, Sparks Street,
Ottawa, Canada.

Desk Novelty

SIR,—I wish to obtain something in the nature of a cigarette box, ash tray, tobacco jar, or lighter, for a desk, mounted with a small model aeroplane. I have made inquiries at all the usual retailers, but it would appear that I am asking for something a little out of the usual. I am wondering whether you know of anyone who manufactures or sells such an article.

D. C. REED.

40, Park Street, W.1.

New Productions in Plastics

Plastic Base for Motor Starter

An extremely complicated plastic base, containing no less than 35 metal inserts, is part of a new reversing motor starter by Ega Electric, Ltd., of Wednesbury, which comprises in one unit forward, reverse and stop buttons, isolator unit, fuses and overloads, and is the most compact assembly yet devised for quick and accurate control for motors from $\frac{1}{8}$ to $7\frac{1}{2}$ h.p. at from 200 to 440 v. and from 0.25 to 11 amps. Operation of the forward button engages contacts electro-magnetically and actuates a pivoted arm which throws the reverse contacts out of circuit; pressing the reverse button similarly throws the forward contacts out of circuit, and no less than 60 reversals per minute are possible.

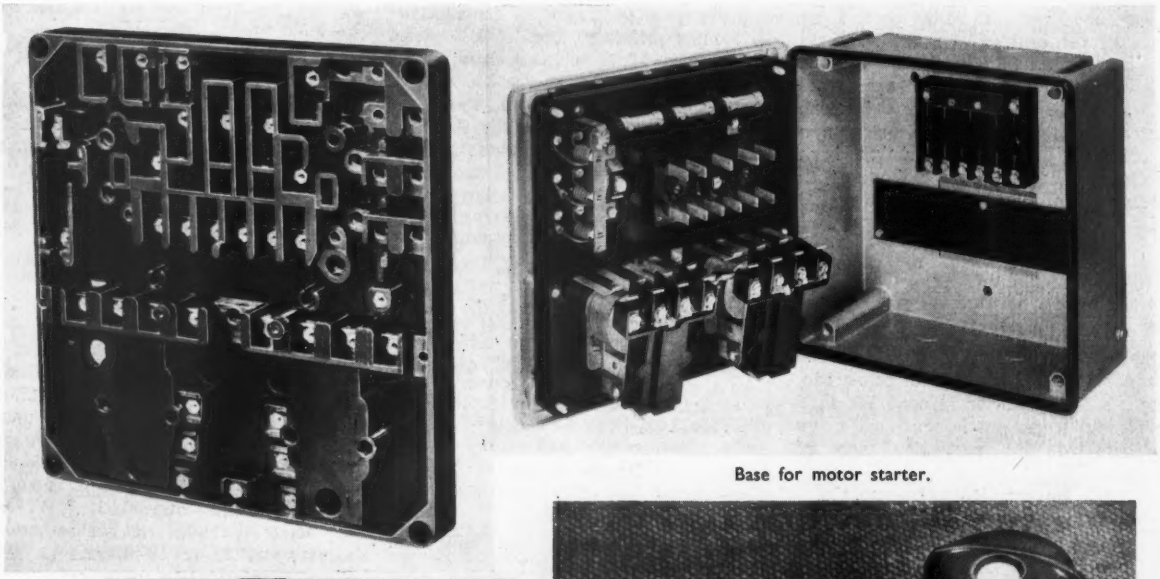
This starter unit is only $8\frac{1}{16}$ ins. high, $4\frac{7}{8}$ ins. deep and $5\frac{15}{16}$ ins. wide, and the complicated plastic base with many metal inserts is made by United Ebonite and Lorival, Ltd. The moulding tool, consisting of three parts—the punch and two-plate die—is operated in a 100-ton hydraulic press. Since there are 35 metal inserts to be moulded into the base a corresponding number of carrying pins are simultaneously loaded into the tool by means of a specially designed jig. Precautions are taken to guard against the shearing of these insert pins when the moulding material flows under the heat and pressure applied. As the base must have anti-tracking properties, the material employed is phenol formaldehyde with cellulose and mineral fillers.

Duct-cleansing Brush

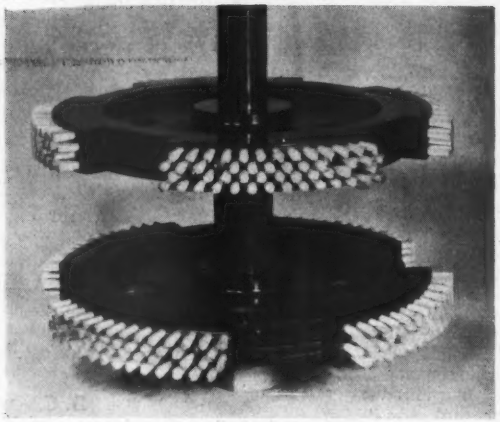
Already widely publicized by Imperial Chemical Industries, Ltd., who supply the nylon filling, with credits to Kleen-E-Ze Brush Co., Ltd., who make the brush, and H. J. Heinz Co., Ltd., who use it for duct-cleaning, this brush is provided with a "Permali" stock and handle. The New Insulation Co., Ltd., of Gloucester, point out that this material was chosen because it is non-warping, impervious to bacilli, and hard enough to endure several refillings without deformation of the knot holes. "Permali" is a wood-base laminated plastic, which is well known in the electrical industry as an insulating material of great mechanical strength, which is also finding new applications in the general engineering field on account of its remarkable physical properties.

Dual-purpose Container

The condiment container illustrated combines the functions of pepper shaker and salt pourer. Internally it is divided into two separate compartments, and appropriate holes are drilled for each at the top of the moulding. A revolving moulded cap having a circular aperture exposes the holes for either pepper or salt as desired. The "closed" position is easily found by turning the cap so that the rib coincides with the ribs on either side of the actual receptacle. Designed by Ronald Brookes, and moulded in "Beetle," this condiment holder is a new item in the "Bandalasta" series of moulded picnicware by Brookes and Adams, Ltd., 250, Barr Street, Hockley, Birmingham, 19. It is available in various colour combinations, and appears to be quite attractive and unusual. (Photo: courtesy B.I.P., Ltd.)



Base for motor starter.



Stock for duct-cleansing brush.

Dual-purpose condiment container.

Engine Cylinder Head

As a result of research by the Engineering Department of the Nuffield Organization, Cowley, Oxford, into motorcar engine startability problems, vital information on the starting of engines at low temperatures has recently been obtained by fitting a "Perspex" head on an orthodox engine, so that the actual combustion effects within the combustion chamber can be clearly seen. Tests with this new equipment have revealed information of the highest value, which has been applied successfully to the design of starting devices.

Unspillable Cell

The latest addition to the range of radio cells and small accumulators manufactured by Chloride Batteries, Ltd., is the new "Exide" unspillable LPM4 in a moulded polystyrene container. This cell was designed principally for "walkie-talkie" apparatus, although it should prove equally suitable for certain domestic radio receivers. The polystyrene container offers many advantages to the user, particularly in countries overseas. It remains unaffected by wide variations in temperature and thus ensuring long life for the cell under tropical conditions. The tough, transparent material retains its attractive appearance throughout the life of the cell. The separators are constructed of "Lignex"—a highly absorbent wood fibre material that greatly reduces the quantity of freely mobile acid in the cell; this type of separation, combined with the specially designed lid, prevent acid spillage in service, even when the cell is completely inverted.

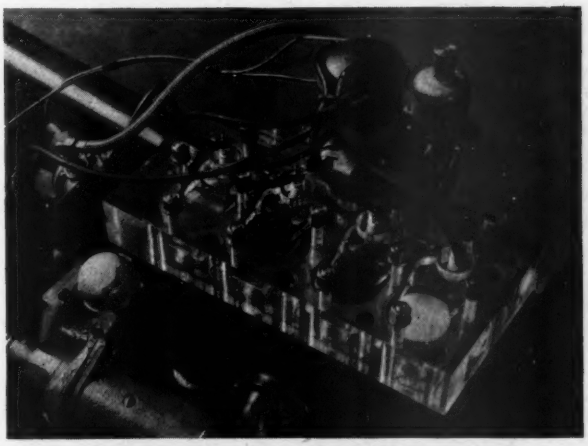
(Above) Extension speaker.

Sandwich Set

The sandwich set which is the subject of one of our illustrations, was made by Thermo-Plastics, Ltd., Luton Road, Dunstable. It departs from conventional designs, as the plates are rectangular in shape, instead of being circular or square. The material employed is clear, colourless "Perspex" and for decorative effect the underside of each piece is relieved by a succession of shallow beads of rectangular outline nested one within another, thus giving the appearance of a Japanese fret pattern. The surface intervening between each bead has a matt finish, conveniently acquired from the mould, and this adds largely to the pleasing appearance of these pieces.

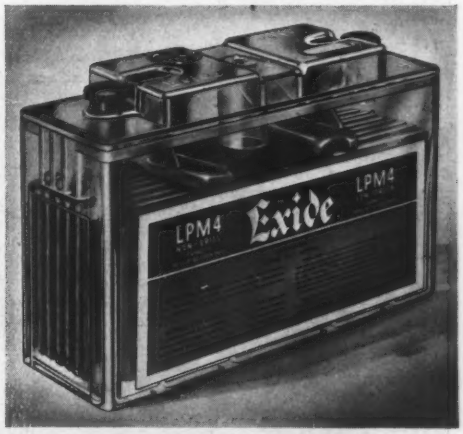
Extension Speaker

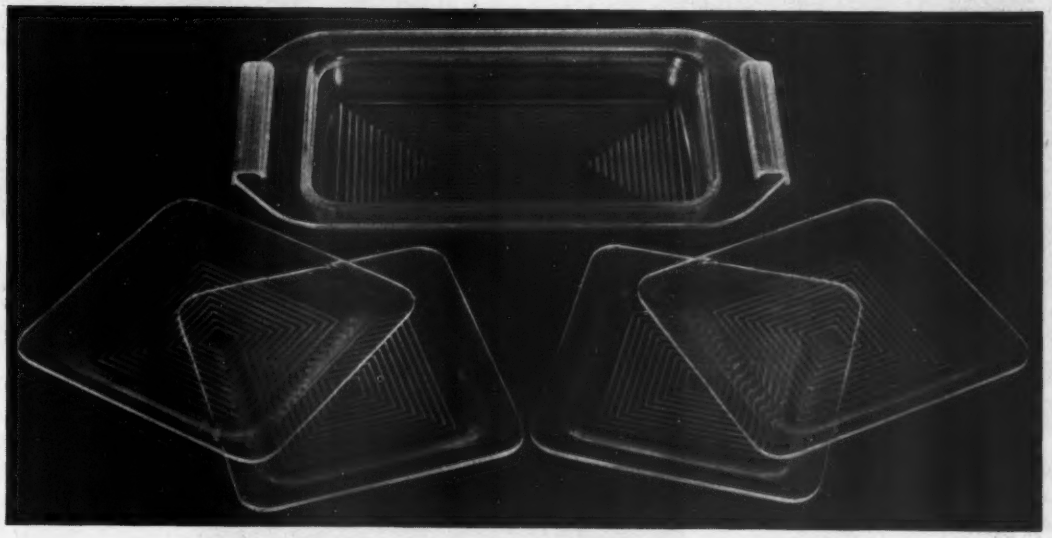
The new "Ekco" extension speaker illustrated, measuring 10 ins. by 10¾ ins. by 4½ ins., is housed in a beige or maroon moulded case with contrasting plastic lattice grille. This grille, injection moulded, is of the type described in "Plastics," May, 1950 (page 139), and is also a product of E. K. Cole, Ltd., Plastics Division. It is easy to keep clean and not so liable to damage as are other materials commonly employed for grilles.



(Left) Cylinder head ("Perspex") for motorcar engine research.

(Right) Unspillable cell (polystyrene) for "walkie-talkie" radio equipment.

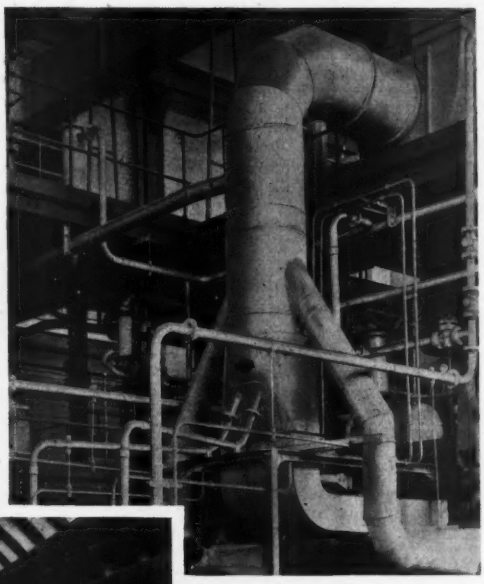




Sandwich set in "Perspex" with attractive decorative pattern.

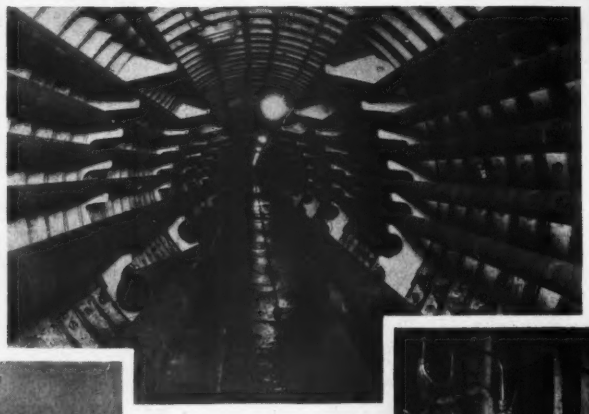
Plastics at the I.C.I. Wilton Works

These photographs show the progress already made on the 2,000-acre site now being developed by Imperial Chemical Industries, Ltd., as the first stage of their project at Wilton. The Wilton works, formally inaugurated September, 1949, includes plants for the manufacture of phenol-formaldehyde moulding powder and "Perspex" acrylic resin. Sites and services will be available to any of I.C.I.'s eleven manufacturing divisions.

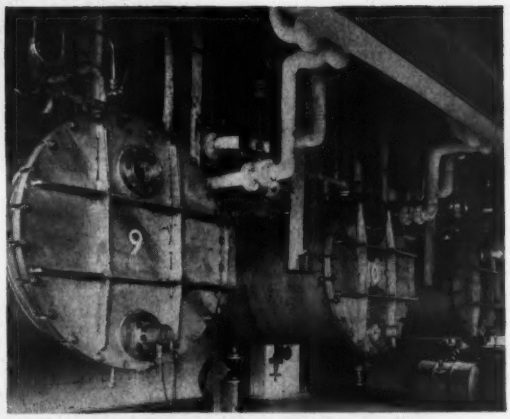


(Above) Part of the phenol-formaldehyde resin plant.

(Above) The phenol-formaldehyde resin plant: resin bunkers and conveying system.

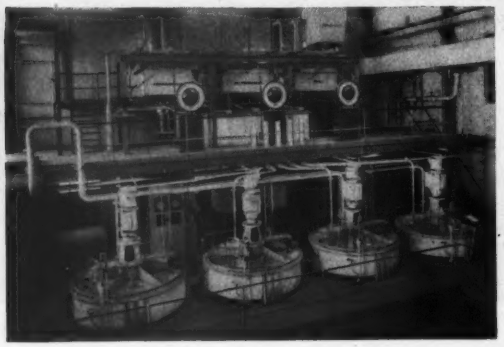


(Above) Pipes in the 9-ft. industrial tunnel under River Tees.



(Below) Another part of the phenol-formaldehyde resin plant.

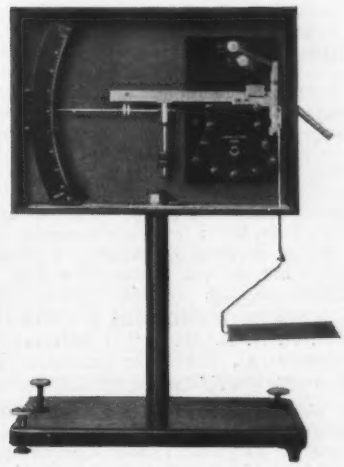
(Above) Vessels for the storage of gas under pressure.



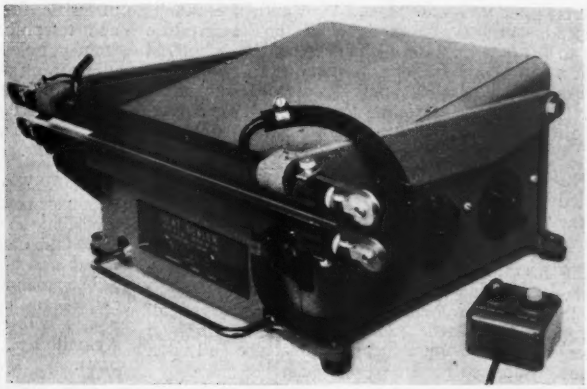
(Above) Part of the "Perspex" sheet plant, showing vessels used in an intermediate stage of manufacture from methyl methacrylate monomer.

PRODUCTION NEWS

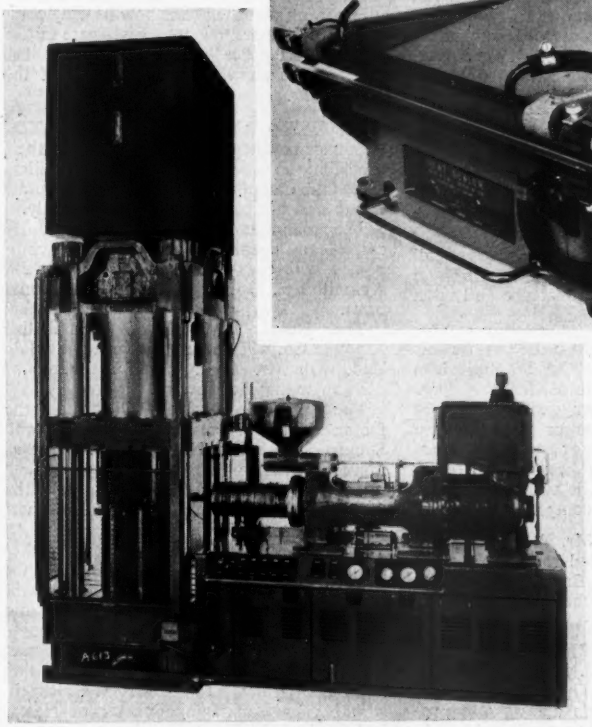
Raw Materials, New Plant, Works Organization, Control Apparatus, Research, Personal and Trade Notes



Balance for sheet-weight determinations.



(Above) "Rediweld" heat sealer for thermoplastic materials.



(Left) "Impco" combined injection-compression machine (32-ounce) model VF type 32-800.

COMBINED INJECTION - COMPRESSION MACHINE.—What is probably the biggest combined injection - compression machine in Europe was recently delivered to Compagnie Générale Belge des Isolants, 49, Avenue Huysmans, Loth - lez - Bruxelles Belgium, and is now successfully in operation. This machine is a standard model manufactured by Improved Paper Machinery Corporation, Nashua, New Hampshire, U.S.A., and sold through their European marketing agents, Finney Presses, Ltd., Berkley Street, Birmingham, 1.

The general characteristics of the machine are: Downstroking compression or clamping unit, 800 tons; upstroking plunger unit, 100 tons; pull back rams, 75 tons; injection unit, 32 oz. single pack and 48 oz. double pack; daylight, 36 ins. minimum, 60 ins. maximum; platen area, 46 ins. by 42 ins. Among several unique patented features is the double pack mechanism which permits the loading ram under electrical control to move twice, and thus packs the heating cylinder to its maximum capacity before heating commences.

This "Impco" unit, in America, is already moulding two complete telephone cases, with various metal inserts, in both acetate and styrene, on a two-minute cycle. The facility by which inserts can be used is best illustrated by the fact that it is now in general use on jobs where the advantages of the flatbed platens are best employed.

The "Impco" injection moulding machines are admirably suited for the moulding of nylon. As the range of temperatures for nylon moulding is relatively narrow compared with other thermoplastics, sensitive heat-control of the heating cylinder is essential; also, owing to its fluidity and quick melting point, it is very difficult to get uniform plasticity during heating and means must be provided for filtering the unfused particles out of the stream of liquid approaching the nozzle. Drooling at the nozzle tip will also take place unless the temperature of the front zone of the cylinder and the nozzle can be so regulated to allow a small slug of nylon to "freeze" in the orifice.

The standard method of fitting three heater bands each with its own temperature controller allows for the necessary sensitive heat-control of the heating cylinder zones. The only extra equipment required is the patented "Impco" nozzle, which is bolted in place of the standard type. This contains a restrictor or spreader and is equipped with heating bands controlled by a powerstat, which can be regulated to give a constant input of power at a voltage which ensures proper performance of the nozzle. The design of the spreader apart from acting as a filter also makes for better softening of the material.

The future programme of Finney Presses, Ltd., includes the manufacture of these "Impco" units in this country, and also the conversion of moulds from the vertical type to the horizontal type, which in itself is a simple matter.

BALANCE.—One of our illustrations shows a useful precision balance for determining the weight per square metre of paper, sheet plastics, and similar material by weighing small samples. This balance is made by Appareils Lhomme and Argy, who is represented in this country by Binney and Smith and Ashby, Ltd., 116, Cannon Street, London, E.C.4. The graduated sector scale carries adjustable minimum and maximum limit indicators for checking weights within certain tolerances. Release of the beam is controlled by a lever, and an oil-damping device stops the movement of the beam in about five seconds. The instrument is totally enclosed, except for the control lever and pan.

HEAT SEALER.—The "Rediweld" H.S.16 heat sealer, introduced by Rediweld, Ltd., Broomhill Road, Wandsworth, S.W.18, has been specially designed for the heat sealing of polythene, a material which is particularly difficult to weld; it can also be used for the sealing of films of polyvinyl chloride, polyvinylidene chloride, "Pliofilm" and other thermoplastic materials of the packaging trade, having been basically designed for the manufacture of bags and envelopes.

The jaws, with a useful length of 16 ins., permit the sealing of fairly large bags in one single operation. Where longer seams are required, in the case of protective covers, for instance, it is possible to make consecutive welds by feeding the material through from either side of the machine; the jaws are easily accessible from both sides. The sealer is also suitable for the welding of tubular plastic containers filled with liquids or pastes, i.e., welds can be made at regular intervals by sealing through the contents.

A foot-operated switch is used to initiate the welding process, and a complete sealing cycle comprises the following steps: (1) The jaws are closed and welding is effected by applying heat in the form of an impulse. (2) The jaws open automatically after a predetermined cooling period. A sealing cycle, including cooling time, comprises approximately two seconds; a further second is required to move the material through the jaws. The "Rediweld" heat sealer can, therefore, produce 20 welds per minute, or 1,200 welds per hour. The individual seams are sharply defined (maximum length 16 ins.,

maximum width ¼ in.); in the case of polythene the seam is fully transparent even when viewed under a microscope. Welding is effected by means of special resistance tapes, using an impulse of accurately known magnitude and duration. The actual sequence of the welding process is controlled by means of three relays. The only parts subjected to wear are the resistance tapes which have to be replaced from time to time. The overall dimensions are 18 ins. by 16 ins. by 10 ins. The maximum thickness of material which can be welded is .008 in.; current consumption (230 volt mains), .6 amp.

BRITISH STANDARDS INSTITUTION. Mr. H. A. R. Binney has been appointed director and secretary in succession to the late Mr. Percy Good.

GAUGE AND TOOL MAKERS ASSOCIATION announce that the Association is organizing a Competition in Craftsmanship and Draughtsmanship for apprentices and learners attached to member-firms, to be held in conjunction with the Gauge and Tool Exhibition, May 15-25, 1951.

In the section for Craftsmanship there will be two age groups, i.e., one for apprentices and learners below the age of 19, and the other for those of 19 and over. In the section covering Draughtsmanship there will not be any separate age groups, but the entries received must have been completed by the entrant during his period of apprenticeship. A panel of experts will be set up to adjudicate the entries, suitable prizes being awarded. Those entries which are of sufficiently high standard will be on view at the New Horticultural Hall, Vincent Square, London, S.W.1, during the period of the Gauge and Tool Exhibition.

DIAMOND TOOLS.—The Industrial Diamond Information Bureau, Industrial Distributors (Sales), Ltd., 32-34, Holborn Viaduct, London, E.C.1, have sent us a copy of their "Bibliography of Diamond as Cutting Tool for Metals and Non-metallic Materials," first published 1945 and now in its second revised edition, with the number of references increased to approximately 480. Copies of this bibliography can be obtained free of charge on application to the Industrial Diamond Information Bureau.

INDUSTRIAL DESIGN COMPETITION.—The eighth industrial design competition organized by the journal "Art and Industry" was sponsored by the Plastics Division of I.C.I. Architectural and industrial design students were invited to submit plans for a hotel reception office, making use of plastics—in particular, "Perspex" acrylic materials. The winner of the first prize (£50) was Mr. Henryk Blachn'cki, a student of the Polish School of Architecture. Mr. Andrew Jackson, of Edinburgh, was placed second, and another student of the Polish School of Architecture, Mr. Andrzej Chwalibogowski, received third prize. The winning plans and models were exhibited on January 25 at the rooms of the British Colour Council, where the winners received their prizes from Mr. Gordon Russell, Director of the Council of Industrial Design, An exhibition of "Perspex" sculpture by well-known artists arranged for the occasion included work by Josephina de Vasconcellos, Arthur Fleischmann, G. H. Friese-Greene, Alexander Jardine, Max Moffett and Leslie Higgins.

DOW CHEMICAL CO., Saran Fabrication Division, Bay City, Michigan, U.S.A., have sent us a copy of their recent publication (32 pages) on "Saran" lined pipe fittings and valves. Since its introduction in 1938, Saran has become widely used where problems of corrosion and abrasion are involved. Lined pipe and pipe fittings can now be used within the temperature limitations of −40 degrees F. and +194 degrees F. for continuous service, and mechanical strength has reached equality with metal pipe. The excellent corrosion resistance afforded by the Saran lining has been increased greatly due to the fact that the plastic is under compression within its metallic sheath which densifies the physical structure. The present publication gives illustrations, dimensions and other details of steel pipe, malleable iron union fittings, cast iron and cast steel flanged fittings, reducing flanges, plug diaphragm and other valves, sight flow and hose connections, all Saran lined. Some useful information is included upon chemical resistance and upon the construction of pipe lines.

T. H. AND J. DANIELS, LTD.—As this company's "Open Day" at Lightpill Iron Works, Stroud, was so successful, they have decided to hold another one on July 14 next. They also inform us that they are keeping "open house" for overseas visitors during the whole of the Festival of Britain, when special guides will be available to show these visitors round the company's works.

E.M.B. CO., LTD.—Mr. R. N. Cadbury, B.A., has been appointed sales director of E.M.B. Co., Ltd., West Bromwich, and will be responsible for the internal sales organization.

I.C.I. WILTON WORKS—Rapid strides are being made by I.C.I. in the erection of new works at Wilton. The "Perspex" and phenolic moulding plants are now in production, and the new urea formaldehyde moulding powder factory is being built. Considerable progress has been made in the construction of the new polythene factory, which will use as its raw material ethylene obtained from the oil cracking plant; at present this gas is made from alcohol derived from imported molasses. At Wilton there is also being erected a production plant for "Terylene," now made on a pilot scale at the I.C.I. Hillhouse factory. The raw materials for "Terylene," ethylene glycol and terephthalic acid will be synthesized from petroleum products obtained from the oil cracking plant which is now nearing completion on the Wilton site. Elsewhere in this issue of "Plastics" (page 48) we publish photographs showing some features of the new works.

BRITISH XYLONITE CO., LTD., announce that as from January 1, 1951, their subsidiary companies, Halex, Ltd., Scintillex, Ltd., and Cascelloid, Ltd., ceased manufacturing and act as selling companies only.

The manufacturing activities previously carried on by the above subsidiary companies will be taken over by the British Xylonite Co., Ltd., organized on a divisional basis.

The Halex Division of the British Xylonite Co. will operate the factory at Hale End, with Mr. T. L. Birrell in charge as division managing director.

The Cascelloid Division will operate the factories at Leicester, Coalville and Stamford, with Mr. H. Senior in charge as division managing director.

The Scintillex Division will operate the factory at Christchurch, with Mr. J. Bernert in charge as division managing director.

The reorganization involves no other change in relationships with customers or suppliers. There have been no changes in staff, except that, coinciding with the reorganization, Mr. C. E. M. Coubrough, managing director of the British Xylonite Co., Ltd., has handed over as managing director of Halex, Ltd., to Mr. T. L. Birrell, who becomes managing director of Halex, Ltd., and of the Halex Division.

BX Plastics, Ltd., and other subsidiary companies are not affected by this reorganization.

On November 23, 1950, eleven members of the staff of Bakelite, Ltd., who had completed 25 years' service with the company or its predecessors, were presented with gold watches by Mr. H. V. Potter, B.Sc., F.R.I.C., M.I.Chem.E., chairman and managing director. Mr. Potter (centre, front row) is here seen with the recipients, and with Mr. F. J. Robinson, assistant managing director, who is standing on the left in the back row; also in the back row are Messrs. R. H. Elliott, W. Holmes, P. Smith, S. C. Short, E. H. Hudson, H. F. Kench, G. M. Hopps, A. Mole. In the front row are Mr. J. Chapman, Miss F. Price, Mr. H. V. Potter, Mr. C. E. Bunn and Mr. A. Robinson.

NATIONAL COLLEGE OF RUBBER TECHNOLOGY.—Work has commenced on a new building for the National College of Rubber Technology, on a site adjoining the Northern Polytechnic, London. The estimated cost, including equipment, is about £170,000. Until the new building is ready for occupation in 1952, the college will continue to be housed in the Northern Polytechnic, where it has been since its inception in 1948. The college was set up by the Ministry of Education at the request of the rubber industry as part of the Ministry's policy to provide national centres for advanced technological education to meet the needs of industries of high national importance requiring comparatively small numbers of trained technologists.

PRINTING BLOCK MOUNTING MATERIAL.—The shortage and high cost of good-quality timber for block mounts has led to the search by the Printing, Packaging and Allied Trades Research Association for alternative and more stable materials than wood as available to-day. By laboratory and practical printing tests the Association has found, from among a number of materials, two resin-bonded wood chipboards which are better than present-day wood and can be used in the same way as the usual mahogany mounts. Both of these materials show little, if any, tendency to warp; compress very little under printing pressure; will take stuck-on or nailed plates; are unaffected by usual forme-cleaning solvents; are less expensive than wood, and are in good supply. Two minor disadvantages of these materials are that tungsten tipped-tools are needed for cutting and planing them, and they swell slightly more than best mahogany when moisture from the air is absorbed. Full details of the tests used to find the most suitable materials will be made available to members of the Printing, Packaging and Allied Trades Association in an interim report shortly to be issued.

HEAT TREATMENT INVESTIGATIONS.—For many years Standard Telephones and Cables, Ltd., have manufactured machines and equipment for the specialized heat processing of materials used in industry, and as large-scale users of the equipment which they make, they claim to have considerable knowledge of the subject. In order that this experience can be placed at the service of other industrial concerns, the company has formed a Heat Treatment Group, as a part of their Industrial Supplies Division, located at Footscray, Kent, where a well-equipped laboratory is available to which manufacturers are invited to send their problems for investigation. Purposes for which heat treatment equipment has recently been supplied includes the hardening of small tools, preheating and softening of plastics material, setting synthetic glues, and curing foundry sand cores.

BRITISH MOULDED PLASTICS, LTD., has purchased the equipment of the Plastics Department of Mansons, Ltd., including their complete range of starter battery moulds and cell lid moulds. The formulæ of Mansons' special compositions have also been acquired, and arrangements have been made to continue supplying all former users at home and abroad. British Moulded Plastics, Ltd., has also installed its existing plant for handling bitumen asbestos compound in a new building, and it has created, as from January 1, 1951, a Bituminous Division which will concentrate on making battery boxes, cell lids, insulators and many other new applications in this field of plastics. Battery separators of all types will be handled by the new division.

O. AND M. KLEEMANN, LTD.—At an extraordinary general meeting held on December 20, resolutions concerning the increase of the capital of the company to £320,000 by the creation of 200,000 5½ per cent. cumulative redeemable preference shares of £1 each and 400,000 ordinary shares of 1s. each, and approving alterations to the articles of association, were duly passed.

WALLINGTON WESTON AND CO., LTD., inform us that their London office has been transferred from 15, Moorgate, London, E.C.2, to Premier House, 48, Dover Street, London, W.1. Phone: Grosvenor 6512.

R. H. COLE AND CO., LTD., 2 Caxton Street, Westminster, S.W.1, inform us that their telephone number has been changed to Abbey 3061 (10 lines).

A. C. WICKMAN, LTD., Tile Hill, Coventry, assumed the sole agency for Tornos machines in the United Kingdom on January 1, 1951. Usines Tornos, of Switzerland, are recognized as the leading makers of sliding head precision automatics, and their range include machines with capacities from 5/32-in. to $1\frac{3}{16}$-in. diameter. Catalogues describing their range of machines can be supplied on request.

MR. K. A. ZANDSTRA, Head of the High Frequency Department of Philips Electrical, Ltd., has been awarded the Bessemer Premium by the Society of Engineers for his paper entitled "High Frequency Heating in Industry." A reprint of his paper dealing with the latest high frequency heating methods in mass production is being issued shortly; copies will be obtainable on application to Philips Electrical, Ltd., Century House, Shaftesbury Avenue, W.C.2.

Mr. James Butler, A.M.I.Mech.E., chief development engineer, British Industrial Plastics Ltd.; chairman of Council, Plastics Institute, 1950-51.

This drawing was made by Fred May, the well-known cartoonist.

MOULDING POWDER IMPORTS.—The British Plastics Federation reports the following details of private account imports of moulding powder for October and November, 1950:—

	Oct. (tons)	Nov. (tons)
Licences issued:		
Cellulose acetate-butyrate (U.S.A.)	49.6	41.5
Polystyrene (Canada) ...	15.1	200.0
Polystyrene (Germany)	—	—
Arrivals:		
Cellulose acetate-butyrate (U.S.A.)	2.0	5.35
Polystyrene (Canada) ...	84.95	133.6
Polystyrene (Germany)	—	—

FORTHCOMING MEETINGS

Feb. 16.—"Modern Hydraulic Presses," by R. Groves (Streetly Manufacturing Co., Ltd.). Plastics Institute, Midlands Section. James Watt Memorial Institute, Great Charles Street, Birmingham, at 6.30 p.m.

Feb. 20.—"Copolymerisation," by Dr. L. Valentine (Birmingham University). Society of Chemical Industry, Plastics and Polymer Group. Manson House, 26, Portland Place, London, W.1, at 6.30 p.m.

Feb. 21.—"Plastics in Surgery," by Dr. J. T. Scales. Plastics Institute, London Section. Waldorf Hotel, Aldwych, London, W.C.2, at 6.30 p.m.

Feb. 21.—"Low Temperature Carbonisation and the Plastics Industry," by Mr. Hazel. Plastics Institute, Southern Section. Polygon Hotel, Southampton.

Feb. 23.—"Developments in Plastic Moulding Plant with Particular Reference to Automatic Operation," by J. L. Daniels (T. H. and J. Daniels, Ltd.). Plastics Institute, North-Western Section.

Feb. 26.—"What the Aircraft Industry Requires of the Rubber Industry." Plastics Institute and Institution of the Rubber Industry, North-Western Section.

Feb. 27.—"The Coating of Paper with Plastic Materials," by S. E. Sorrell (Leonard Stace, Ltd.). Plastics Institute, North-Eastern Section.

Feb. 27.—Dance, Victoria Hall, Bloomsbury. Plastics Institute, London Section.

Mar. 7.—"Cellulosic Plastics." Also film entitled: "The Story of Tenite," by B. T. A. Holland (Kodak, Ltd.). Plastics Institute, Yorkshire Section.

Mar. 8 or 9.—Gala Dance. The Ambassadors Ballroom, Birmingham. Plastics Institute, Midlands Section.

Mar. 14.—"Vinyl Latices." H. C. Drinkwater. Joint meetings with the Institution of the Rubber Industry. Plastics Institute, Southern Section. Polygon Hotel, Southampton.

Mar. 16.—"Fabrication of Laminated Materials," by N. Sabin, Esq. (Insulation Equipments, Ltd.), Plastics Institute, Midlands Section.

Machines for the Industry

The Windsor Injection Moulding Machine

Continuing our description, with 'exploded' drawings, of various machines for the plastics industry, we now publish details of the Windsor H.E.7 injection moulding machine, made by R. H. Windsor, Ltd., of London.

THE Windsor H.E.7 injection moulding machine described in this article was designed to supersede the older air-operated machines of the same type manufactured previously, and to produce articles in all types of thermoplastic material up to 1 or 1½ oz. in weight.

The machine, which is entirely self-contained, is hydraulic in operation, but the moulds are opened and closed and finally locked by manual effort. Therefore, although widely used in the plastics industry, it is the simplest type of injection machine in use.

Constructional Features

The right-hand or headstock end of the machine base contains the hydraulic control valve gear and its various components. The electrical control units are installed on the left-hand or tailstock end of the machine and are mounted on a panel.

Referring to Fig. 1, the open section of the base clearly shows the self-contained flange motor drive (7), with pump (6), directional control valve (9), relief valve (10), oil reservoir (11) and filters (8). The directional control valve is operated by the hand lever (13), and the movement of this lever causes oil to flow either to one side or the other of the piston in the hydraulic cylinder (5). The movement of this piston is transmitted by a coupling to the plunger (17, Fig. 2) of the material cylinder, and also to actuate the slide of the hopper feed (18), as shown in Fig. 2. The mould plates (20, Fig. 2) are moved on the press tie bars (4) by the rotation of the manual operating handles (1) through the toggle linkage (2).

Temperatures varying between 150 and 300 degrees C. are necessary for the injection moulding of the majority of thermoplastic materials, and in order to provide the necessary heat and control same, the material cylinder, of which a sectional view is given (Fig. 3), is heated by means of two elements, one being internal (26), and the other an external band heater (23). The energy input to these two elements is controlled by means of energy regulators housed in the electrical control box (12) and by means of the 4-in. dial thermometer with cut-out thermostat hand, seen in Fig. 1, immediately behind the hopper of the machine.

The introduction of hot plastic material into the moulds, and the necessity for quick cooling so that the moulded articles can be ejected as soon as possible makes it necessary to have water cooling to the moulds, and this is provided by the cooling water regulating valves (3).

Setting the Machine

The setting of the machine is extremely simple. The mould to be used (14) is first fixed securely to the left-hand or moving mould plate, and right-hand or fixed mould plate, so that both halves are in correct alignment and the sprue bush in

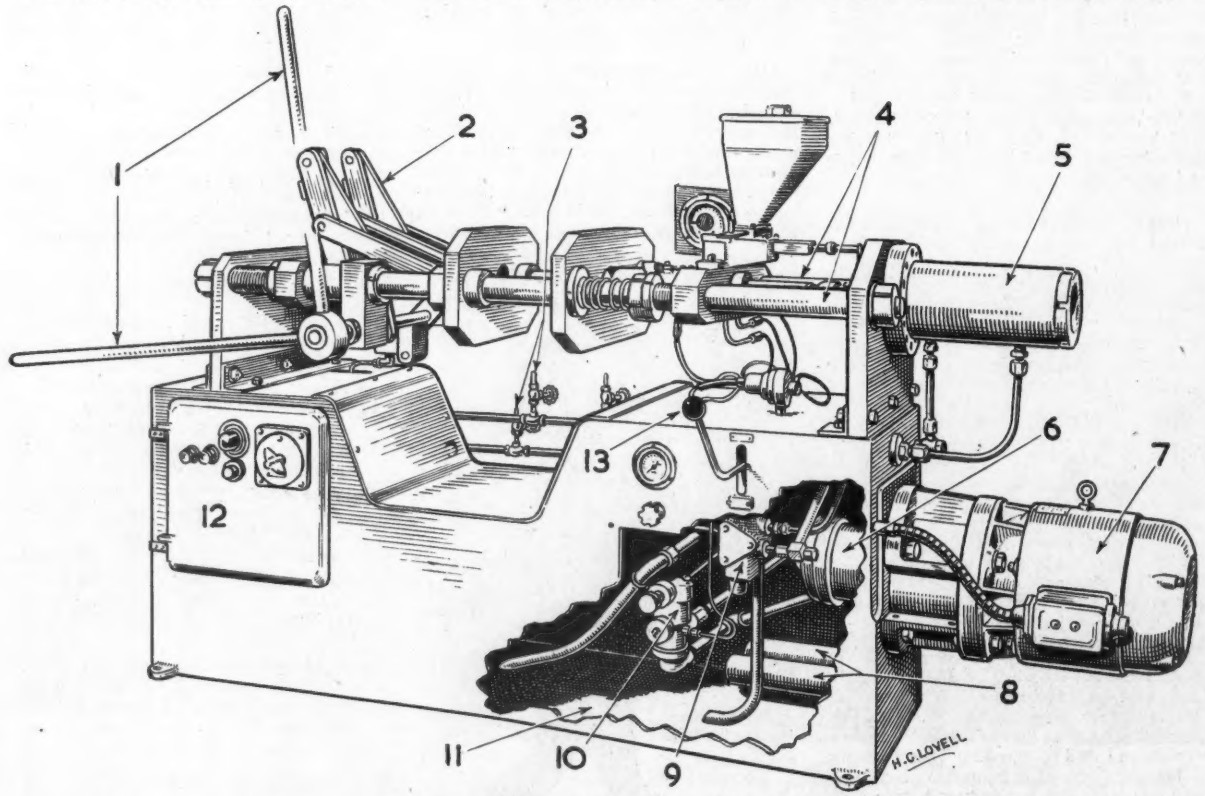


Fig. 1.—The Windsor H.E.7 injection moulding machine.

1.—Mould locking handles.
2.—Toggle linkage.
3.—Cooling water connections.
4.—Main tie bars.
5.—Hydraulic injection cylinder.
6.—Pump.
7.—Electric motor.
8.—Oil filters.
9.—Directional control valve.
10.—Pressure regulating valve.
11.—Oil reservoir.
12.—Electrical control panel.
13.—Injection control handle.

the mould is in alignment with the nozzle of the machine, this being done by centralizing the sprue bush on the nozzle prior to bolting the mould to the mould plates.

It is then necessary to set the machine with an adequate locking pressure in order to withstand the effect of the injection pressure within the cavity of the mould, and this is done by adjusting the position of the toggle levers (2) on the tie bars (4) by means of the threaded portion shown clearly in Fig. 1 at the rear of the bars. The locking pressure must not, of course, be taken on the nozzle of the material cylinder, but is taken by the mould plate stop nuts behind the headstock mould plate, this being the plate nearest to the hopper.

The machine is capable of exerting a locking pressure of 17 tons maximum, but for normal working, unless the mould has an exceptionally large surface area, the locking pressure will be set at approximately 10-12 tons, at which setting the operating handle (1) will close with comparative ease for either youth or female labour.

Operating the Machine

The operation of the machine is quite simple, and with the machine set in the aforementioned manner it is only necessary to consider the actual component which it is required to produce. These considerations entail the type of material being used, the most suitable temperature at which the material can be moulded, the weight of the shot and sprue, and also the superficial area of the moulded article and the most likely injection pressure which will be required to produce good mouldings.

The machine is rated at 1-2 oz. capacity, and normally moulds for this size of machine will be designed to produce single articles up to approximately 1 oz. in weight, or multiple cavities of the same article up to about the same weight. In considering the weight of the article which can be moulded on this size of machine, attention must, of course, be given to the area, and since the maximum locking pressure of the machine is 17 tons, the area of the moulded articles should be limited to between 6-10 sq. ins. This is only an empirical formula, however, and with certain jobs much larger areas can be moulded.

The required temperature is set on the thermometer pre-set hand, and the energy regulator controlling the energy input to the elements of the material cylinder is adjusted to some suitable position, probably 60 per cent. or 70 per cent. full on, so that when the machine is being worked with a uniform time cycle, without interruptions, the energy input is regulated by the energy regulator housed in the heating control box (12), but is keeping pace with the heat which is being taken out of the machine in the form of finished mouldings. With the machine operated in that manner, the thermometer reading will remain stationary to within 1 or 2 degrees of the set temperature, this figure being only determined by experience of the operator or setter of the machine.

The injection pressure is variable from 100 to 1,000 lb. per sq. in. by means of a regulating knurled screw located in the main relief valve (10), the actual reading of the pressure setting being given by the pressure gauge shown adjacent to the control lever (13), which operates the hydraulic piston and injection plunger.

The mouldings are ejected on the opening stroke of the rear mould plate (20, Fig. 2), the ejector stem or similar means for ejection, with which the mould will be fitted, coming into contact with an adjustable screwed rod which is mounted on the rear plate of the machine centrally with the mould plates.

The machine being hand-operated, there is very little danger of any type of accident occurring which might injure the operator, but a safety valve is fitted underneath the toggle mechanism and takes the form of a hydraulic pilot valve. A roller on the end of this valve comes into contact with the toggles, and is so positioned that the toggles have to be straight before the valve is in an open position. The hydraulic pump cannot attain any pressure until this valve is in that position; consequently it is impossible to inject hot material into the mould until it is fully closed.

Cycle of Operations

Summarizing the foregoing remarks, the cycle of operations for the Windsor H.E.7 injection moulding machine is as follows:—

(a) Close the moulds.
(b) Inject.
(c) Hold injection pressure (usually from 4 to 10 seconds).
(d) Return the plunger.
(e) Allow time to elapse for cooling and curing the mouldings.
(f) Open up the moulds and eject the mouldings.

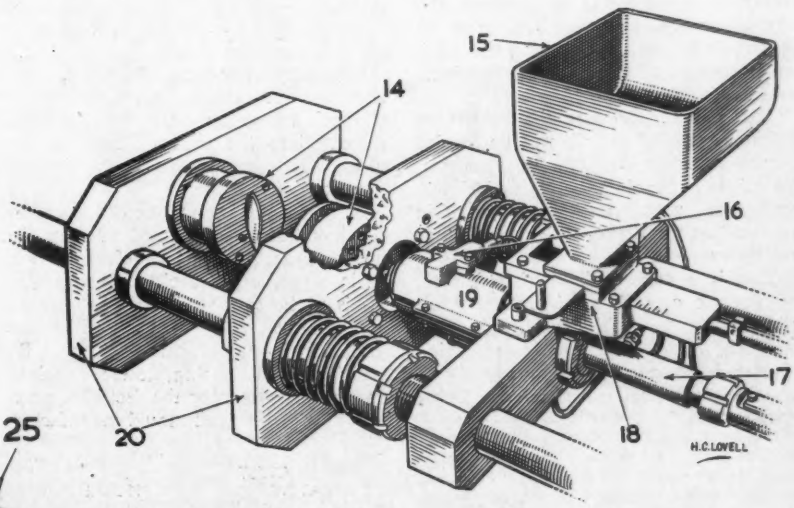
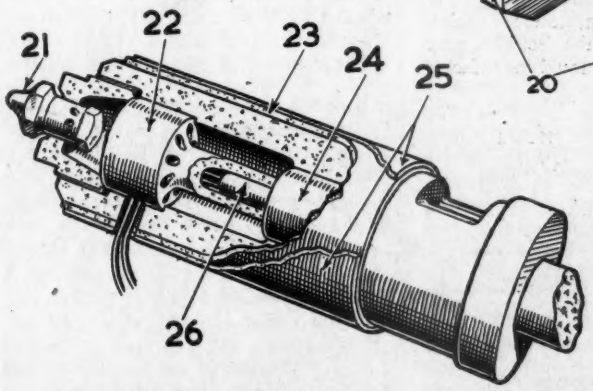


Fig. 2 (above)—General assembly of mould plates, cylinder and hopper feed, for Windsor H.E.7 injection moulding machine.

14.—Mould.
15.—Hopper.
16.—Thermometer bulb housing.
17.—Injection plunger.
18.—Hopper feed.
19.—Material injection cylinder.
20.—Mould plates.
21.—Nozzle.
22.—Spreader.
23.—External heating element.
24.—Injection plunger.
25.—Element cover.
26.—Internal heating element.

Fig. 3 (below)—Details of material cylinder.



Successful Designing for Plastics Moulding—XVII

By W. M. HALLIDAY

CONTINUING our discussion on ribs, Fig. 1 shows further rib designs which will be of interest. The first (A) depicts a partial cross-sectioned view of the wall of a component. As will be noted, this is of narrow thickness. A very substantial rib has to be formed on one side of this wall, opposite to the parting-line "a—a" of the mould.

This rib is required to fulfil the dual purpose of bracing the slender wall section, and also to serve as the locating point whereupon another component may be affixed. For this latter purpose the crest of the rib is recessed down for its full length to provide the parallel-sided slot into which the auxiliary member has to be mounted.

The height of the rib, to the bottom of this moulded step, is, of course, determined by the point of location required for this secondary component of the assembly. This dimension is such as would entail an unduly heavy mass of material at that point in the component wall, and to avoid this undesirable feature it will be noticed that the rib is hollowed out on its underside to a substantial extent.

By means of this provision the wall thickness through the component and ribbed portion is maintained more or less uniform, thereby ensuring the minimum amount of trouble when moulding and curing the part in the tool.

The core for forming the hollow on the underside of the rib will be carried in one mould block in the usual manner. The sides of the rib are suitably inclined, and the root portions each side radiused as explained with reference to earlier examples.

This is a very useful design feature, worthy of careful consideration when ribs of very considerable height and width have to be employed, and which if not hollowed out would result in certain practical difficulties being encountered.

The other example (B) illustrates the formation of a rib when the mould parting line is located across the rib as shown at "a—a." Such a disposition will result in a flash line being formed along the crest of the rib as depicted.

This design will also necessitate a somewhat awkward matching of the half cavity formations in each mould block. In certain cases the presence of such a mould flash line would result in the disfiguring of the component and from the appearance angle could not be permitted.

On the other hand, there are numerous types of mouldings requiring ribs, where it will not be possible to dispose the mould parting in any other plane than across the rib as shown at B. In fact, the location of the flash line at such points may in some instances prove an advantage by reason of the greater simplicity afforded its removal at the buffing or trimming stages after moulding.

With many industrial type mouldings having to perform purely utilitarian functions, and where appearance is not of vital moment, it may be found that considerable economies can be derived when performing the trimming operations, by having the flash situated along the crest of a rib, rather than at some more inaccessible point.

Generally speaking, however, ribs should be located so that the whole channel formation may be machined directly into the solid material of one block. This will always be the simplest for the mould maker.

All these and numerous other similar considerations will demand attention by the component designer before he will be in a position to decide what form of rib is to be employed, and the manner in which they have to be located relative to the main mould parting plane. By judiciously balancing these various factors, and assessing the facilities, practical advantages, and mould manufacturing economies associated with each form, it will be possible to make the best and most economical selection.

General Design Considerations

It will be helpful at this juncture to mention very briefly some of the chief considerations to be studied:—

(1) It will be essential to ascertain whether the proposed rib or ribs will be situated in such a position on the external or internal surfaces of the component relative to the disposition of fixed or movable cores, etc., as will allow the finished moulding to be extracted in the simplest, quickest, and safest manner.

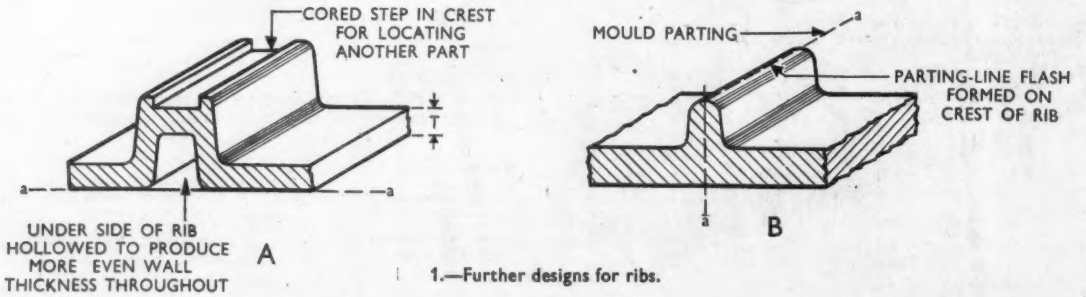
With mouldings having a complex configuration and involving numerous core plugs, inserts, and like complicated features, this matter may not be easy to resolve. In all cases where there is doubt or conjecture as to the suitability of a rib form and location, the matter should be placed before the mould designer for his guidance.

(2) It will also be necessary to determine whether the proposed rib formation is of a kind capable of being easily reproduced in the mould, with the customary mould manufacturing equipment. The lack of understanding of the basic requirements of mould production may easily lead the component designer unwittingly to specify a shape of rib, or a location for same which will be exceedingly difficult and costly to reproduce when making the mould.

(3) If the rib is required as a strengthening device for the walls of the component then it will be essential to be assured that the rib is located in the best position for that purpose.

In some cases it may be found that a single rib will suffice merely to bridge the distance between, say, two bosses formed integrally on the wall. In other cases it may be necessary to provide a number of ribs, diagonally disposed so that a large slender surface of the component will be stiffened.

(4) Where a rib is required merely for improving the external appearance, it will be necessary to decide whether it is of the correct shape, and form, and whether its introduction will not involve other moulding difficulties likely to lead to the creation of other surface defects.



1.—Further designs for ribs.

(5) Consideration should also be given to the question of whether the proposed rib is of a kind likely to interfere with or impede subsequent finishing operations required on the moulding, i.e., trimming, buffing, etc.

(6) Where the rib has to be of substantial proportions and is to be used not solely for strengthening the wall, but as a means of anchorage for another piece or member, consideration will have to be given to the increase in the volume of material entailed in the rib and wall on which it joins. This may often reveal the need for hollowing-out the opposite side of the rib in some manner, so as to retain the wall thickness more uniform throughout the ribbed section, in the manner shown at A (Fig. 1).

Failure to attend to this point may result in innumerable troubles being encountered at the moulding stages, and the causation of defects of the finished component itself, i.e., such as undercure of the heavily massed portions, porosity, distortion and kindred faults.

(7) It will also be advisable to consider in this same connection in what manner and to what extent any proposed ribs will affect, alleviate or retard the normal shrinkage of the component, both whilst it still remains in the mould and later when it has been ejected therefrom.

As already explained earlier, one of the chief and most recurrent difficulties to be contended with by the moulding engineer is that of the warping of the critical wall sections of a component. To a large extent this will be determined by the kind of plastics material, and its moulding requirements, the degree of complexity of the component and the mould, and the quality of the latter tool.

Ribs should, however, be of such a shape and be so located relative to critical cores, bosses, openings, and so forth, that they tend to minimize unequal contraction forces occurring in the component as far as possible. This will mean in practice that the ribs may have to be disposed in other than the positions envisaged by the component designer in order the more successfully to counteract the stresses arising from cores, or bossed-up thick portions of the piece.

(8) A check should also be made when, having finally selected the best form of rib shape and its exact location on the walls of the component, to ensure that the sides will be suitably inclined to give the maximum ejection draft along the line at right angles to the main mould parting.

(9) The design should also be carefully checked when the ribs have been finally settled, to determine whether the total weight of the part still remains within the capacity of the machine.

When introducing extensive ribbing, say, to the inside wall surfaces of a moulding, this may be easily overlooked. It will apply most particularly to the case of mouldings of very large surface area, whose strengthening requires very long ribs, and to form which will entail much additional material.

(10) In the case of precision mouldings having certain dimensions to be retained within close limits of variation, if ribs are to be employed in the design, some consideration must be afforded the question of how such ribs may affect the dimensional accuracy and stability of successively moulded articles.

In such circumstances, it will be the best course for the component designer to seek the advice and expert guidance of the moulding engineer. Very often considerable help can be derived by the application of ribs at specific points to ensure that the dimensional accuracy of portions of the moulding will not be impaired by excessive contraction, or warpage.

To determine the best location for ribs to meet such requirements is, of course, an expert's job, demanding extensive practical knowledge of the plastic moulding process, and the behaviour of plastics materials during moulding.

Some Reasons for Employing Ribs

Ribs may be adopted for the following purposes:—

(a) To obtain greater economy in the amount of material required to form a particular moulding. By introducing ribs it will often be found possible to decrease the general basic wall thickness without in any way detracting from the strength and rigidity of the finished article.

(b) Conversely, ribs may be employed to increase the strength of a hollow or open-ended component without unduly adding to the volume of material.

(c) Ribs may be used successfully to give better control over the stability of precision dimensions which are to be held to close limits. This will be derived by the counteracting tendencies exerted by the rib against unequalized contraction stresses, or the drag of cores, etc.

(d) Ribs are very often adopted as being one of the simplest means for minimizing the effects of distortion, warpage, and bending which otherwise would mar the shape, appearance, and strength of a component.

(e) Ribs, in one form or another, may be used with great advantage to improve the appearance and æsthetic values of the moulding.

(f) With compression-moulded components ribs may be used to obtain a more equalized distribution of heat over the critical working areas of the mould. This will make for quicker and smoother operation of the tool, and greater freedom from numerous practical snags and surface defects on the component.

(g) Ribs can often prove of the greatest assistance to the mould engineer by ensuring closer control over the direction of flow of the plastic material within the mould during injection or cure. This will ensure sounder components and the more uniform operation of the mould.

(h) Ribs are often employed to hide surface defects which would otherwise be brought into undesirable prominence on large, flat surfaces.

(i) Ribs may be used as a means for bearing the parting line flash so that this would not be located upon more important surfaces, or to ensure its readier and more economical removal.

(k) Ribs will also very often be adopted in order to distribute stresses over a much larger surface area of the component than would otherwise be possible.

(l) Ribs may also be adapted to fulfil the dual purpose of stiffeners for the wall of the component, and as points of location or anchorage for other elements used in conjunction with the moulding. Very often the rib may have to be made with considerable height and width, and should therefore be hollowed after the fashion explained to avoid concentration of unduly heavy masses of material.

(m) The mould engineer will sometimes desire to employ ribs in order to ensure that the component will be more effectively retained on the moving or on the fixed mould block during certain stages in the moulding cycle.

(To be continued)

HORNERS' COMPANY AWARDS

The Council of the British Plastics Federation, as administrators of the Worshipful Company of Horners' Awards, offer a prize of the value of 50 guineas for the design of an article made wholly or mainly in plastics, to be set out as a drawing with a written description of the proposed process for manufacturing the article and accompanied by a three-dimensional model or mock-up of the article.

The prize is open to employees of 12 months' standing or more with member firms of the British Plastics Federation. Entries, on which the name of the candidate must not be written, should be submitted with the following information in a covering letter:—Name, address, and age of the employee, name of employers and length of time he has been employed by them, with a letter from a responsible official representing his employers, giving permission for the entry to be submitted.

Neither the British Plastics Federation nor the Worshipful Company of Horners claim any copyright in the designs submitted. Candidates should select their subjects from the following:—(i) Bathroom equipment. (ii) Nursery equipment. (iii) Office equipment.

Entries should be sent to the General Manager, British Plastics Federation, 47-48, Piccadilly, London, W.1, so as to reach him not later than July 31, 1951.

PATENT REVIEW

The following abstracts have been made from specifications at the Patent Office, with the permission of the Controller of H.M. Stationery Office. Complete specifications can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 2/- each.

B.P. 643,964. Appl. 23.3.45. Conv. (U.S.A.) 19.10.44. Acc. 4.10.50.

Bonding of abrasive bodies by means of synthetic resins. To: Montclair Research Corp.

Use of silicone resins as bonding agents for the manufacture of grinding wheels, abrasive paper and cloth, etc.

B.P. 643,980. Appl. 2.8.46. Acc. 4.10.50.

Thermo injecting moulding press and process. K. W. Hall. To: Baldwin Locomotive Works.

Process for "transfer moulding" thermosetting plastics comprises heating and plasticizing the material to a mouldable state by extrusion under high pressure from a pressure chamber to a transfer chamber with a relatively low pressure; collecting the material in this chamber and raising the pressure to transfer the material into the mould cavity. Extrusion pressures of 30,000 lb./sq. in. pressures in the transfer chamber up to 5,000 lb./sq. in. are mentioned.

B.P. 643,990. Appl. 30.11.46. Conv. (Germany) 28.11.42. Acc. 4.10.50.

Extrusion apparatus for producing cable insulations, profiles, rods, threads and the like from plastic materials. V. Vltavsky.

Hydraulically operated extruding machine with a pre-heating chamber from which the plasticized material is transferred into the actual extrusion chamber filled with a conventional torpedo and die system. Extrusion is carried out by means of hydraulic pressure; a non-return valve is provided between pre-heating chamber and extrusion chamber.

B.P. 644,008. Appl. 28.3.47. Conv. (U.S.A.) 29.3.46 Acc. 4.10.50.

Production of shaped articles of polytetrafluoroethylene and copolymers thereof. To: E. I. du Pont de Nemours and Co.

Manufacture of "Teflon" mouldings to close dimensional tolerances comprises the following steps: (a) subjecting finely divided powder to pressure in a die to form a shaped body; (b) heating this body in the absence of pressure to a temperature above 327 degrees C. until it is sintered; (c) cooling the sintered body to a temperature below 250 degrees C. under pressure in a die with the exact size of the finished article.

B.P. 644,057. Appl. 7.8.47. Conv. (U.S.A.) 28.2.44. Acc. 4.10.50.

Welding of non-metallic thermoplastic materials and the fabrication of products therefrom. G. C. T. Lindh. To: The Udylite Corp.

Special hot gas torch for the bonding of plastic shoe soles of laminated construction consists of a tubular body with a heater element over which a stream of air or other gas is passed.

B.P. 644,243. Appl. 21.7.48. Acc. 4.10.50.

The jointing together of pipes or tubes. C. Porter and F. J. Hayes. To: Insulating Materials, Ltd.

Describes method of making elbows and T-pieces from plastic impregnated paper or fabric for the jointing of tubes and pipes made from the same materials.

B.P. 644,287. Appl. 29.10.45. Conv. (U.S.A.) 22.11.44. Acc. 11.10.50.

Production of crystalline unsaturated alkyd resins and copolymerizable compositions and amorphous resins therefrom. To: American Cyanamid Co.

Impregnating resins for cloth and fibrous materials. Fumaric acid is reacted with a glycol of the general formula $HO(CH_2)_xOH$ where $X=2$ to 18. The resulting products may also be used as adhesives or for laminating purposes.

B.P. 644,305. Appl. 23.12.46. Conv. (U.S.A.) 3.7.46. Acc. 11.10.50.

Apparatus for shaping sheet thermoplastic material centrifugally. To: Goodyear Aircraft Corp.

See also B.P. 619,675. Process and machine for the forming and moulding of thermoplastic sheet material. The mould is rotated around an eccentric axis and the heated sheet is formed into the mould cavity by centrifugal force. Counter weights are provided to balance the mould during rotation. Used for manufacture of aircraft canopies from "Perspex" and the like.

B.P. 644,354. Appl. 27.8.46. Conv. (France) 24.6.43. Acc. 11.10.50.

Injection moulding of small articles. Lucien Mazzoni.

Design of multi-impression mould for the production of chaplets, beads, etc. The material is fed along channels to cavities so shaped as to form a depression in the article at which subsequently separation between individual mouldings takes place. It is claimed that the parting line in the finished article is almost imperceptible.

B.P. 644,429. Appl. 28.8.47. Conv. (U.S.A.) 28.8.46. Acc. 11.10.50.

Treatment of polythene. To: E. I. du Pont de Nemours and Co.

Process for the production of a substantially grainless, freely extrudable polythene which comprises forcing the polymer at a temperature above 100 degrees C. through a confined space between concentric surfaces, one of which is rotating relative to the other at a speed of at least 90 ft./min. It is claimed that highly transparent film can be produced from the treated material.

B.P. 644,450. Appl. 11.11.47. Conv. (U.S.A.) 19.7.46. Acc. 11.10.50.

Moulding and laminating compositions. H. P. Wohnsiedler and W. S. Sloatman, Jr. To: British Industrial Plastics, Ltd.

Refers to thermosetting resins which have incorporated in them a plasticized thermoplastic resin; e.g., polyvinyl butyral is plasticized with o-cresyl glyceryl ether, compounded subsequently with melamine formaldehyde resin. The resulting product can be moulded into products with a high degree of toughness, flexibility and impact strength.

B.P. 644,468. Appl. 2.1.48. Acc. 11.10.50.

Production of new resinous polyesters. H. Zenftman and A. McLean. To: I.C.I., Ltd.

Process for the production of resinous materials based on condensing an aryloxyphosphoryl dichloride and a dihydroxy aromatic compound. Products are claimed to adhere particularly well to metal, glass, etc., and can be used as coating compositions. They are transparent and highly resistant to water and acids and stable up to 300 degrees C.

B.P. 644,477. Appl. 24.2.48. Acc. 11.10.50.

Methods and apparatus for coating electric conductors by extrusion. W. T. Blackband. To: The Minister of Supply.

Manufacture of high-frequency cables with P.T.F.E. insulation. Powder material is ram-extruded into a mould which is heated electrically or by electromagnetic induction. Sintering takes place under compression and it is claimed that this process prevents formation of air pockets in the dielectric material during sintering and final extrusion.

B.P. 644,516. Appl. 22.4.48. Acc. 11.10.50.

Flexible tubular structures made of thermoplastic material. J. J. Hinton. To: Dunlop Rubber Co., Ltd.

Automatic machine for the production of thin-walled thermoplastic tubes from sheet material (e.g., polyvinyl chloride, polyvinylidene chloride and copolymers). Material is fed in strip form, folded around a stationary former and high-frequency welded by means of co-operating roller electrodes. Provision is made for automatic cutting-off of the welded tubes.

B.P. 644,563. Appl. 27.5.46. Acc. 11.10.50.

Laminated composite materials for lining walls and like purposes. B. Polovtseff and C. H. Cook. To: The Airscrew Co. and Jicwood, Ltd.

Heat and sound insulating material made from sawdust or the like and a resinous binder in the form of phenol formaldehyde or urea formaldehyde resins. Slabs of this board can be provided on the outside with a layer of adhesive which permits sticking to wall surfaces. For transport purposes sheets of a material such as cellulose acetate are used to cover the adhesive layer. (See: B.P. 644,564.)

B.P. 644,584. Appl. 4.2.47. Conv. (France) 31.10.45. Acc. 11.10.50.

Packages for small objects such as tablets and the like. C. Nicolle.

Manufacture of "unit packs" from two sheets of plastic material. A comparatively substantial sheet of cellulose acetate is moulded to form a pocket and a thinner film of cellulose heat-sealed to the moulded sheet by means of an intermediate layer of thermoplastic adhesive.

B.P. 644,620. Appl. 16.12.47. Conv. (U.S.A.) 16.12.46. Acc. 11.10.50.

Method of polymerization. To: Philips Petroleum Co.

Method of polymerizing an unsaturated organic compound which comprises polymerizing the compound in the presence of a mercaptan and a diazo thioether to form a high molecular weight linear polymer. The organic compound may be a butadiene/styrene dispersion.

B.P. 644,677. Appl. 24.5.48. Conv. (U.S.A.) 29.5.47. Acc. 18.10.50.

Polymers of monovinyl phenoxthines. To: British Thomson-Houston, Ltd. See also 644,678.

B.P. 644,779. Appl. 6.3.47. Conv. (France) 21.9.39. Acc. 18.10.50.

Production on extensible contractible tubular, annular or the like film products, for example, caps or rings for stoppering bottles. To: Novacel S.A.

Manufacture of elastic bottle caps from a solution of a resin and plasticizer, e.g., polyvinyl chloride in acetonylacetone with tricresyl phosphate. A former is dipped into the solution and an elastic film deposited on the former. It is then immersed in a solvent, washed and the film removed from the former. An elasticity of 100 per cent. is claimed for the product. See also 644,790.

Here is the Bush B.P. 10 battery portable radio set in its all plastics case. This case, with its happy combination of compression and injection moulding, was designed by British Moulded Plastics Ltd. in close collaboration with Bush Radio Ltd. Particularly ingenious is the neat arrangement of tuning scale and controls under the scale cover which switches on the set when it is lifted. The body, with its removable back, is made from maroon coloured phenolic material, and the speaker grille, the rigid handle, the controls and the scale cover are all made from cream coloured polymethyl-methacrylate material.

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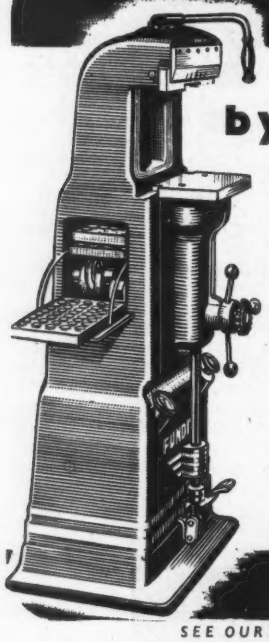

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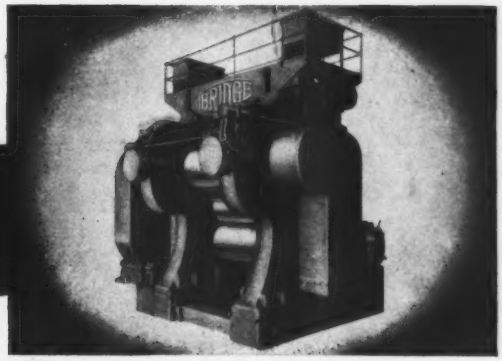

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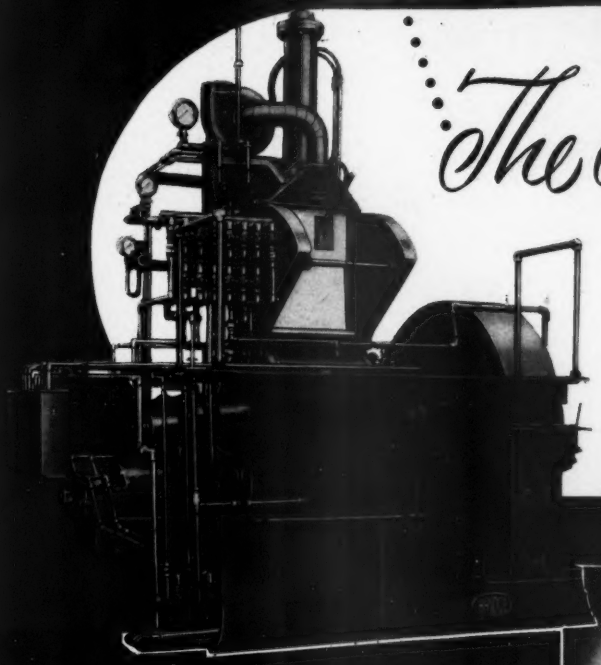

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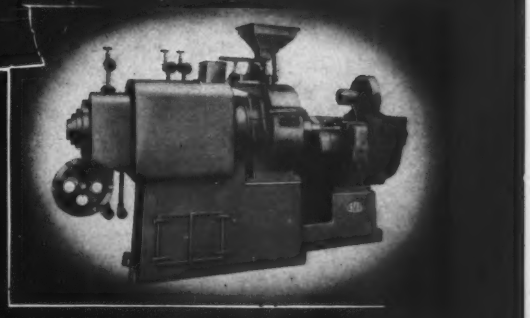

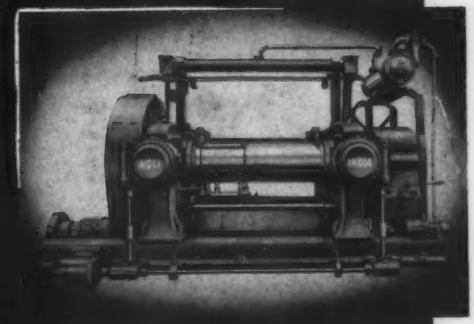

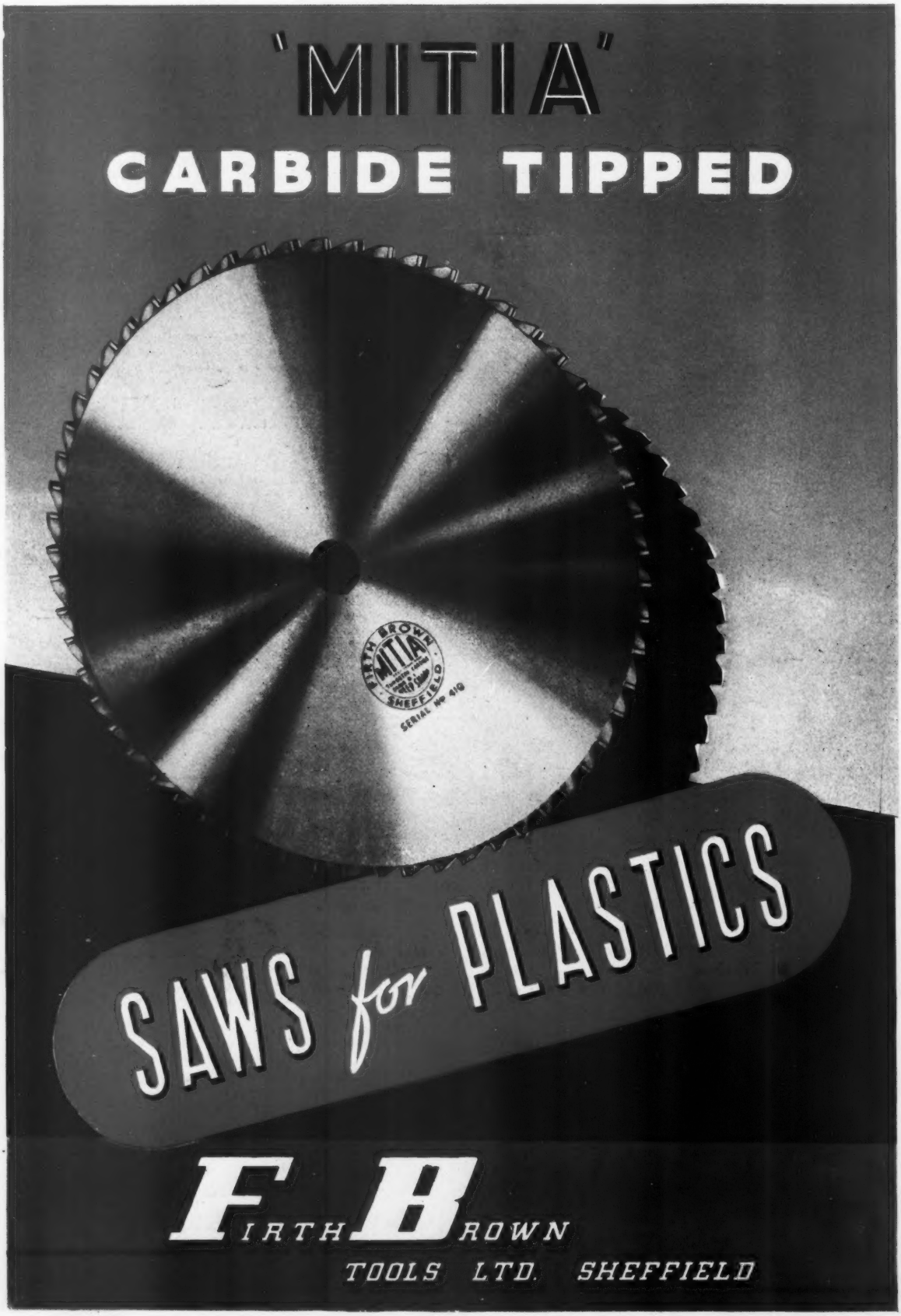
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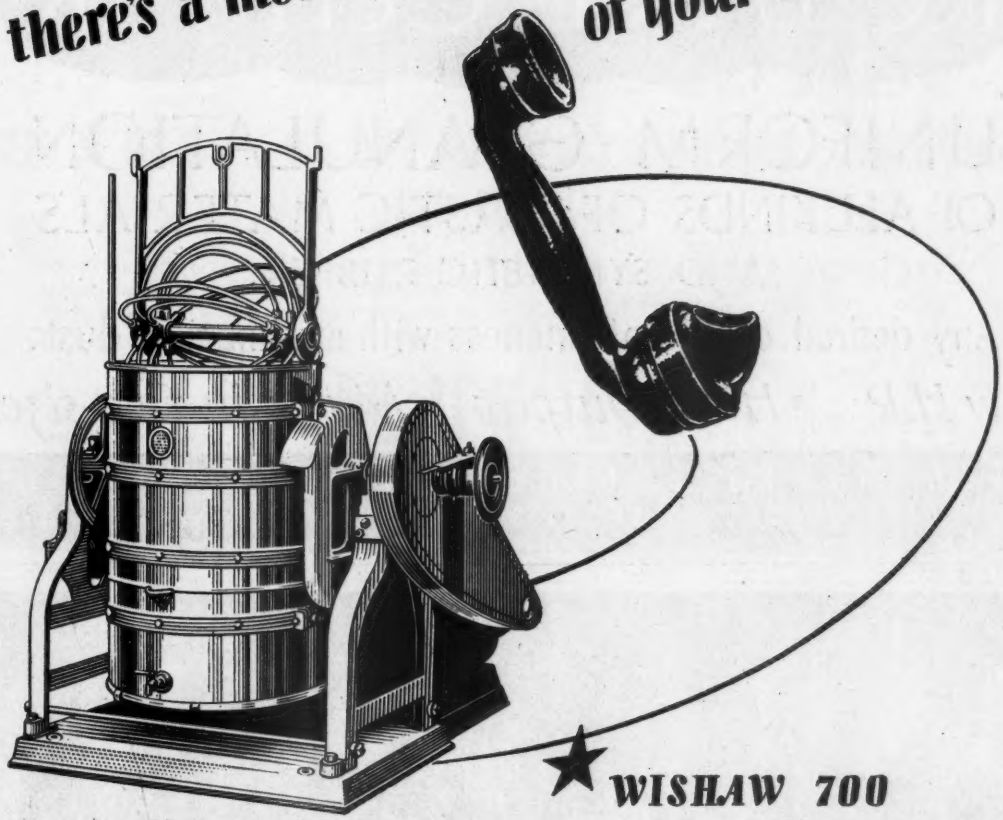

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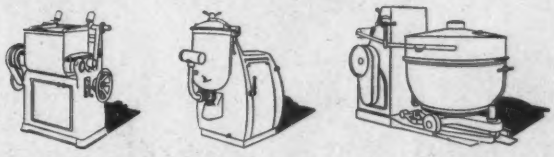

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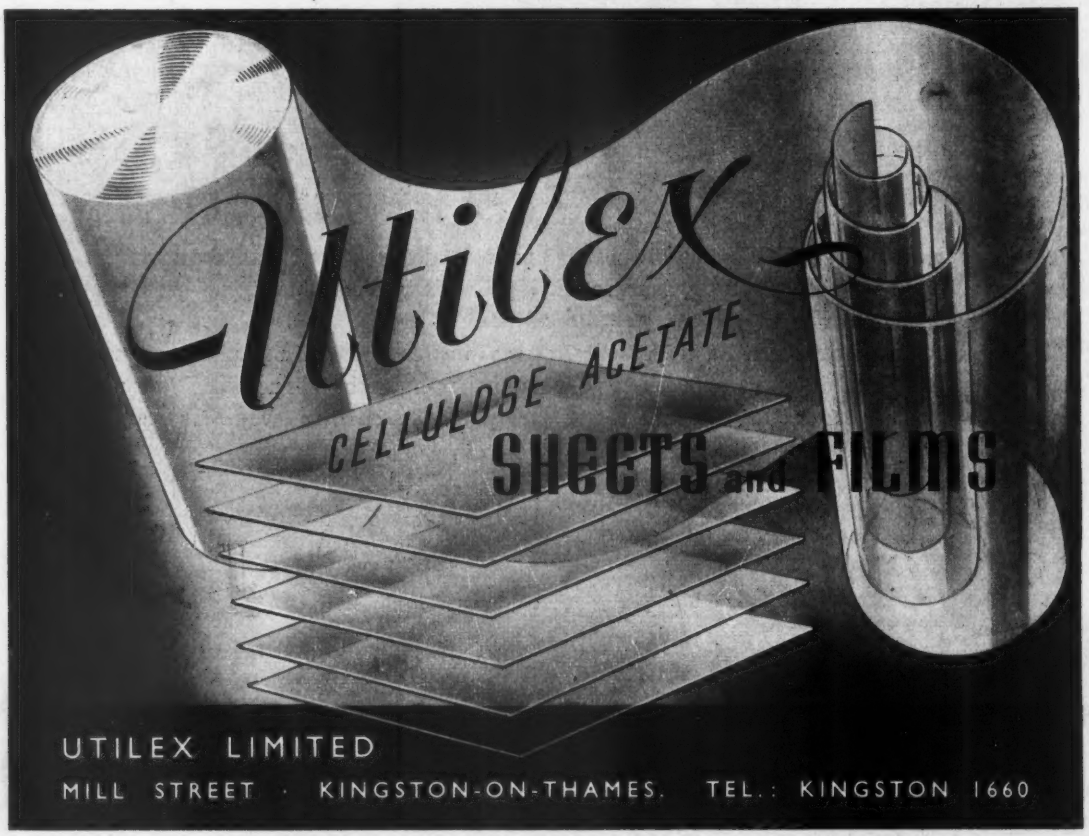

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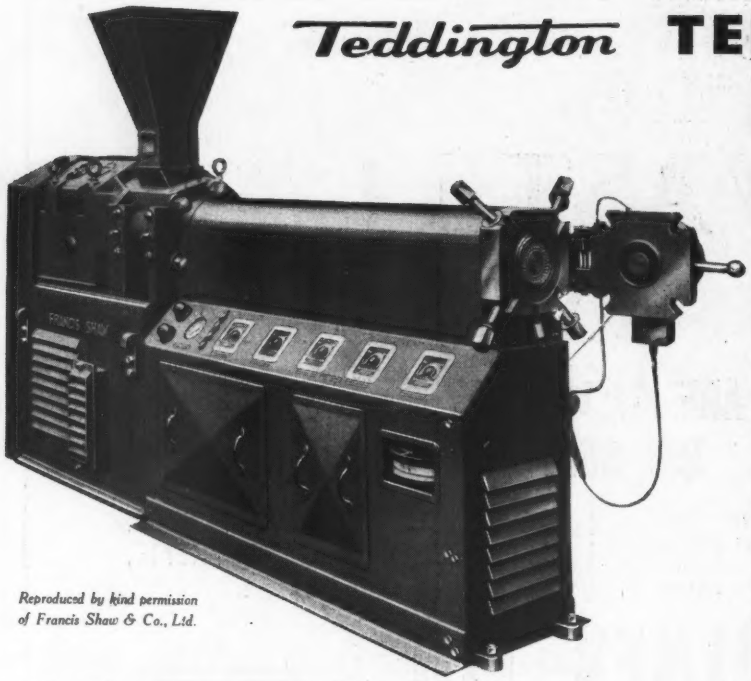

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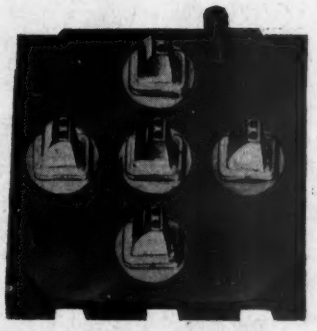

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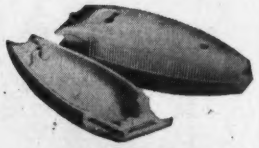

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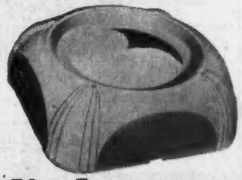

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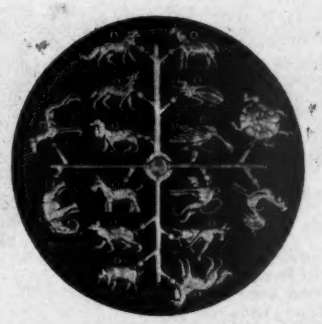

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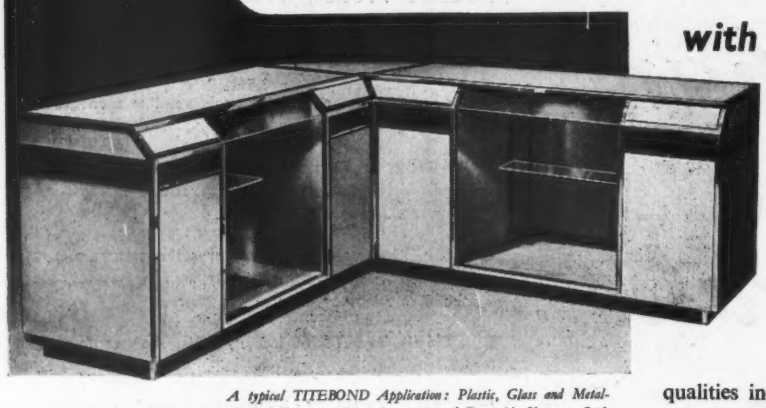

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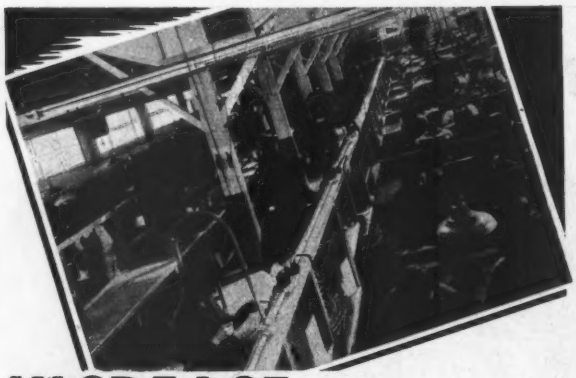

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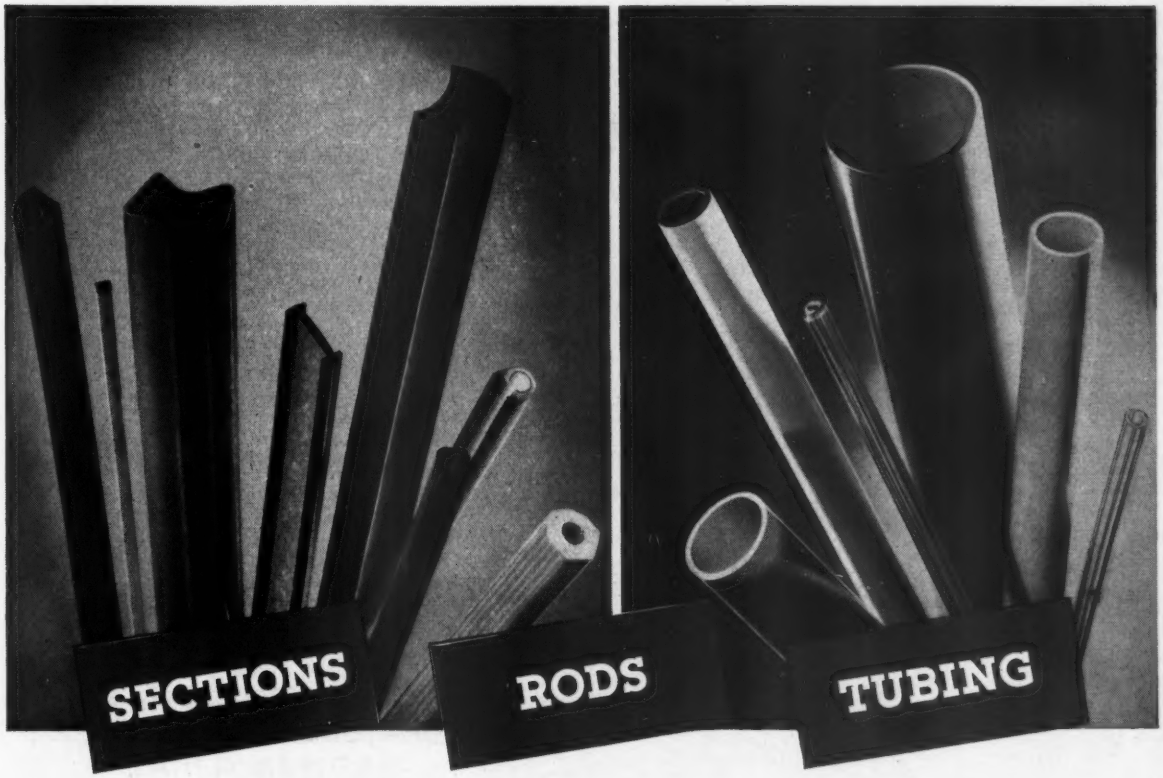

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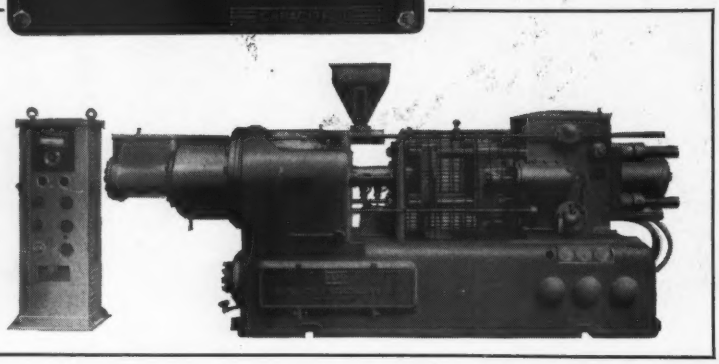

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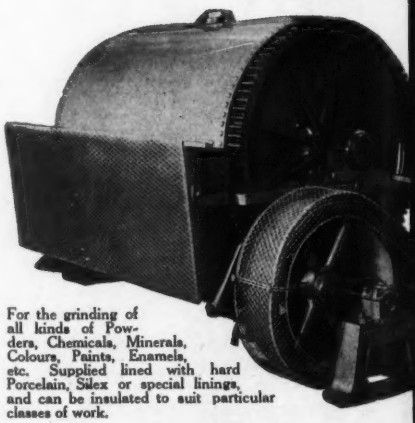

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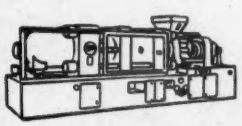

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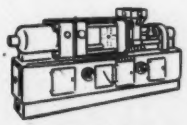
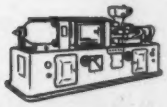


32 ounce



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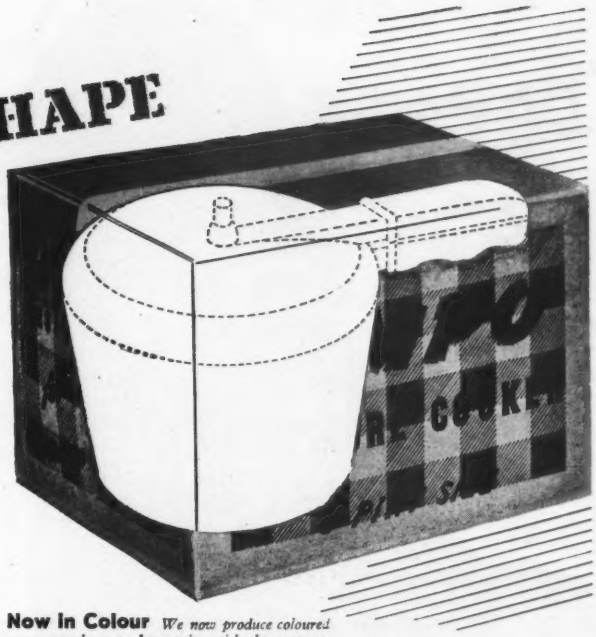

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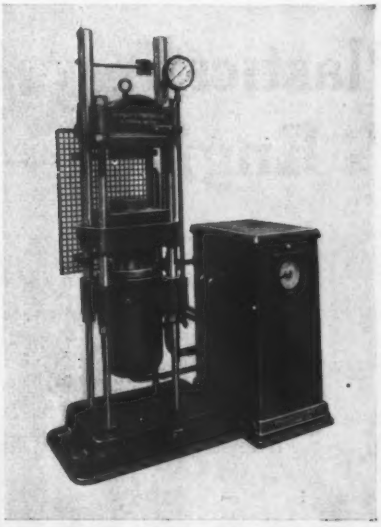

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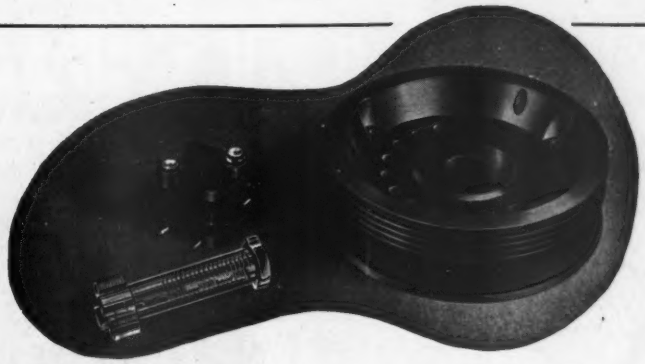

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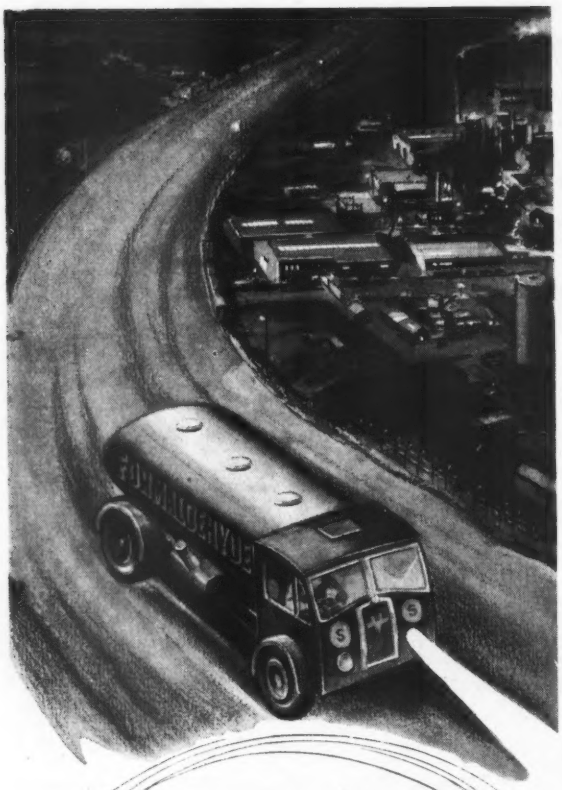

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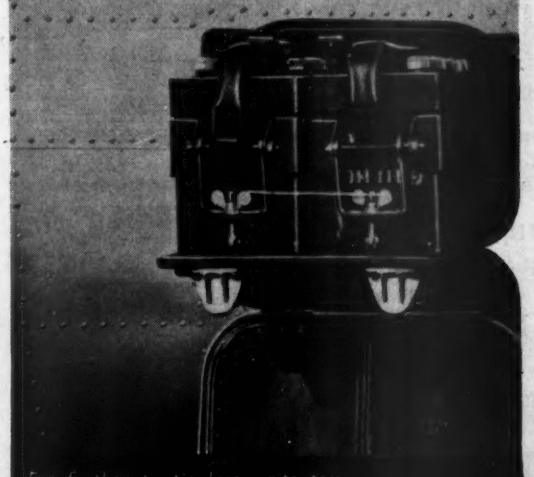

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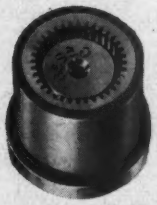

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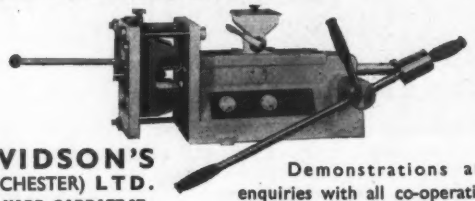

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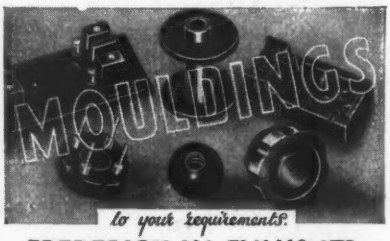

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WANTED. Back numbers of Plastics Institute Transactions as follows: Nos. 3, January, 1933; 5, January, 1934; 6, July, 1934; 7, January, 1935; 10, June, 1936. Please write Box P5814, care of "Plastics." 163-31

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Machinery, Tools and Plant (contd.)

P.V.C. EMBOSSING CALENDAR, 3-roll 72-in. working face with steel embossing shell, complete with latest-type Metro-Vick infra red heaters, drive and motor suitable for P.V.C. leathercloth or unsupported sheet, pigskin shell included. Can be seen at Vinyl Products, Ltd., Butter Hill, Carshalton, Surrey. zzz-296

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DANKS ECONOMIC BOILERS.

TWO Danks horizontal self-contained hot-water or low-pressure steam economic boilers, new 1944, 5-ft. diameter by 9-ft. overall length, fitted with 50-2-in. diameter smoke tubes 6-ft. 6-in. long, complete with grate for hand firing, fittings and mountings, induced draft fan, trunking, chimney, etc., capacity approximately 1,000 lb. per hour each at 50 lb. pressure.

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QUANTITY OF RUBBER OR PLASTIC SPREADING MACHINES by Platt Bros. and Co., Ltd., in good condition, roller width 63 ins. Apply Woodfield and Turner, Parsonage Mills, Burnley. Phone 3065. 168-2168

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PATENTS

THE PROPRIETORS of Patent No. 594,835, for "Method for the Preparation of "Wood Pulp", desire to secure commercial exploitation by licence in the United Kingdom. Replies to Haseltine Lake and Co., 28 Southampton Buildings, Chancery Lane, London, W.C.2 163-8

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WE ARE ABLE TO UNDERTAKE certain short or long runs of highly specialized medical and technical plastic moulding products, injection, compression or sheet fabrication; use our services for the preparation of prototypes All inquiries strictly confidential. Box P4613, care of "Plastics." 163-25

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RAW MATERIAL AVAILABLE AND WANTED

THERMOPLASTIC SCRAP. We are regular buyers of thermoplastic scrap, P.V.C., Polyethylene, etc. Please make offerings to A. Schulman, Inc., 500 Fifth Avenue, New York, U.S.A. 164-2041

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CATALIN RODS. Large quantity for sale, 7/16-in. diameter, 21 ins. long, in translucent amber, red, blue; also tortoiseshell, honey mottle and black at 25% under list prices. John Castle and Co., Ltd., 5 Hurley Road, Kennington, London, S.E.11. Reliance 4274. 163-26

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Allans, 37 Farringdon Street, E.C.4. Phone, Cen 5947. 163-25

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Top prices offered for surplus stocks. All types of plastic scrap, etc. 12 Stedman Road, Bournemouth. Phone, Southbourne 505. 163-22

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WORKING FOREMAN-TOOLMAKER required for factory near Woking (½ hr. Waterloo). Must be fully conversant with production of moulds for bakelite and press tools. Must be strict disciplinarian, age about 40. Good salary and permanent position to right man. State previous experience in chronological order. Replies treated in strictest confidence. Box P6316, care of "Plastics." 163-33

DESIGNER-DRAUGHTSMAN required for charge of Bakelite mould design for moulding shop, S.W. London area. Long experience of compression mould design essential. Knowledge of transfer mould design an advantage. Box P615, care of "Plastics." 163-23

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